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PROSPERITY GAMES PROTOTYPING
with the American Electronics Association, March 8-9, 1994

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ABSTRACT

Prosperity Games are an outgrowth and adaptation of move/countermove and seminar War Games. Prosperity Games are simulations that explore complex issues in a variety of areas including economics, politics, sociology, environment, education and research. These issues can be examined from a variety of perspectives ranging from a global, macroeconomic and geopolitical viewpoint down to the details of customer/supplier/market interactions in specific industries. All Prosperity Games are unique in that both the game format and the player contributions vary from game to game.

This report documents the Prosperity Game conducted under the sponsorship of the American Electronics Association in conjunction with the Electronics Subcommittee of the Civilian Industrial Technology Committee of the National Science and Technology Council. Players were drawn from government, national laboratories, and universities, as well as from the electronics industry. The game explored policy changes that could enhance US competitiveness in the manufacturing of consumer electronics. Two teams simulated a presidentially appointed commission comprised of high-level representatives from government, industry, universities and national laboratories. A single team represented the foreign equivalent of this commission, formed to develop counter strategies for any changes in US policies.

The deliberations and recommendations of these teams provide valuable insights as to the views of this diverse group of decision makers concerning policy changes, foreign competition, and the development, delivery and commercialization of new technologies.

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EXECUTIVE SUMMARY

We currently live in an economic environment that is highly competitive and global in nature. Alliances and interactions among industry, government, university, and laboratory groups could develop synergies that would improve American competitiveness and lead to a higher standard of living and quality of life. However, the diverse interests and constituencies of these groups do not easily lend themselves to recommendations agreed to and understood by all parties. Prosperity Games, adapted from move/countermove and seminar war games, provide a method to explore the interactions among these groups and the marketplace. These games can be a useful tool for addressing the complex problems of national economic competitiveness.

The prosperity game concept is new and still under development. To improve the game's rules, processes, and utility, we have initiated a testing and development program. The electronics industry was chosen as an initial focus of the development effort. The American Electronics Association (AEA) graciously encouraged us and provided industry players for this second prototype session, which was held March 8-9, 1994, in Washington, DC. The Electronics Subcommittee (ESC) of the Civilian Industrial Technology Committee of the National Science and Technology Council (NSTC) provided government players and assessed the utility of Prosperity Games for application to the mission of the Electronics Subcommittee.

In this prototype, two Blue Teams were assembled to act as presidentially appointed commissions to recommend policy changes that would enhance US competitiveness in electronics manufacturing. Blue Team membership is assumed to be comprised of high-level representatives of government, industry, universities and national laboratories. In the game, AEA, industry, government, university and national laboratory people played all four roles. Similarly, a Purple Team represents the foreign equivalent of the Blue Team, formed to develop counter strategies for any changes in US policies. A Green Team represents the marketplace, and provides an assessment of the possible outcomes of the policy recommendations. In this prototype, a President Team was added to assess the strategies and provide guidance for refinement and improvement.

Over the course of three sessions, the Blue Teams (I and II) developed a different set of assumptions and recommendations. Blue I focused on global competitiveness and a "technology explosion." They produced three strategies emphasizing: increased government/industry partnerships; increased availability of low-cost, long-term capital; and the development of a national technology delivery system. Blue I initially also suggested: improvements in fiscal, monetary, trade and regulatory policy; support for a national/international enhanced information infrastructure; and government partnering with specific industries targeted by foreign countries. In subsequent sessions, these strategies were subsumed into one or more of the three primary strategies mentioned above.

In contrast, Blue II imagined a polarized world filled with regional conflicts, and technology *haves* and *have-nots.* They formulated three strategies dealing with re-engineering government regulations so they add value to national competitiveness; shifting investments from government-performed R&D to university and industrial R&D; and education reform and improvement.

As in the previous prototype with the Board of Governors of the Electronics Industries

Association (EIA) prototype, the Purple Team developed great enthusiasm in playing their roles of the foreign competition, and drew many conclusions similar to the EIA Purple Team. They saw the combination of current US laws, culture, business philosophy, and taxation policy as being highly favorable to foreign competitors. Their primary strategy was to support and encourage the existing US environment, and to continue to promote the current Purple policies (as perceived by the Team) in trade, market strategies, politics, obfuscation, and disinformation. They proposed many strategies: continue to exploit US openness; control high-tech tooling; gain political power among the individual states of the US through economic influence; acquire the best US companies; promote additional US government regulations in ethics, accountability, environment, minority, and social areas; erect barriers to direct US investments in the Purple country; influence the US media, and continue a "win-lose" foreign-style (as they perceived it) set of negotiating tactics.

Despite extensive verbal and numerical feedback from the Green and President teams, the Blue and Purple teams did not make any substantive content changes in their original strategies formulated in the first session. The Purple Team believed that the Blue strategies were "wimpy" and would prove to be ineffective and no threat to Purple. In contrast, the Blue teams appeared to be similarly satisfied with their strategies: "The US is ahead. We are doing fine." All three teams tended to modify the form in which their strategies were presented to the Green Team, rather than reassess them.

The Green Team developed sixteen criteria by which to assess the efficacy of the Blue and Purple strategies. When applying their subjective estimates of relative importance and overall impact, Blue I's strategy to increase the availability of low-cost, long-term capital scored the highest (231.64 out of a maximum possible of 323.1) of the six strategies that were evaluated. The next three highest scores were attributed to education reform (167.79), a national technology delivery system (159.66), and support for the national information infrastructure. The lowest scoring strategies were reduce non-value added regulations (114.18) and shift funding from government to industry and universities (83.02).

None of the Purple strategies was scored separately, nor were they consolidated under the heading used at the EIA game of "business as usual."

In projecting the impact of the strategies on four key metrics (standard of living, worker productivity, domestic production, and domestic profits), the Blue I Team scored highest (3.89→4.07, out of a maximum possible 5), Blue II second (3.00→3.54), and Purple last (3.18). The ranges reflect Green Team perceptions of strategy changes after the first and second sessions. These scores contrast strongly with the EIA Green Team which gave the Purple Team the highest score for its business-as-usual approach.

Assuming the current rates of growth estimated for Blue and Purple countries, the 20-year projections for Purple show that it will surpass the US in almost all economic areas, despite the low scores assigned to it by the Green Team.

We originally assumed that feedback from the Green Team would provide additional stimulation to rethink and rework the proposed strategies. However, this seems not to have occurred at the AEA prototype and is one aspect of the game that needs improvement.

Some progress was made in accomplishing the objectives of the game. However, a poll of the players (29% from industry, 43% from government, 28% from laboratories and academia) showed scores that were generally lower than those produced by the EIA players, who were almost entirely from industry (92%). Two specific areas to improve deal with laying the foundation for a technology roadmap and improving the game format. To address this, we extensively polled the staff and players, which yielded 127 recommendations, some of which were contradictory.

The primary guidance will be to: improve the Green Team roles and operations; secure a diverse and appropriately prepared set of expert players; ensure that the game format maintains enthusiasm, and encourages self-critical assessment and refinements of strategies; and provide data to support a set of consistent and reasonable metrics.

As with all new endeavors, there is much to be learned. The players and staff were enthusiastically supportive of both the EIA and AEA prototype games. Future games will build on this experience to better accomplish our ambitious goals.

INTRODUCTION

A prosperity game is a new type of forum for exploring complex issues in a variety of areas including economics, politics, sociology, environment, education, research, etc. The issues can be examined from a variety of perspectives ranging from a global, macroeconomic and geopolitical viewpoint down to the details of customer/supplier/market interactions in specific industries. The concept originated in meetings with the staff of New Mexico Senator Jeff Bingaman, with Lee Buchanan of the Advanced Research Projects Agency, and with other government and industry people.

Prosperity Games explore complex issues

The new forum was first prototyped with a small group of directors at Sandia National Laboratories. A second prototyping game was sponsored by the Electronics Industries Association (EIA), and was held in January, 1994.[1] A third prototyping was sponsored by the American Electronics Association. Those results are reported in this document.

Game Objectives

This Prosperity Game explored the possible interactions among government, industry, laboratories, and universities that could enhance national economic competitiveness. Prosperity games encourage dialogue and connections among the participants, can discover success factors for improving the international competitiveness of the United States industrial base, and can stimulate ideas that could later be crafted by the participants into valuable guidance and policy. The games are not vehicles for advising the government nor will there be any attempt to generate consensus.

Prosperity Games ... can discover success factors

These games provide a safe (not for attribution) environment with knowledgeable and committed players representing all aspects of the problem through move and counter-move simulated actions.

With an initial focus on high-value-added information-related electronics manufacturing, this Prosperity Game was designed and prototyped to fulfill the following purposes for the various customers and stakeholders:

- Stimulate thinking in a focused and directed fashion to help develop new insights regarding future technology policy;
- Facilitate the development of synergistic relationships among key individuals from the four entities (industry, government, national labs, and academia);
- Develop an understanding of the roles and relationships of, and the interactions among the four identified groups;
- Explore the value of using a long-term (10-20 year) time horizon when thinking about and crafting technology policy;
- Lay the foundation for a roadmap to economic competitiveness in the mass-marketed, information-related consumer electronics industry;
- Provide informed input to individuals for developing possible legislation;

[1] "Prosperity Games Prototyping with the Board of Governors of the Electronics Industries Association, January 20-21, 1994," Sandia National Laboratories Report, March 30, 1994.

An important objective of all the prototyping sessions is to evaluate how well the game format and player selection facilitate the accomplishment of the above goals. Lessons learned from this session will be applied to continually improving the games in the future.

Game Theory

In mathematics, game theory is the study of strategic aspects of situations of conflict and cooperation. "Game Theory approaches conflicts by asking a question as old as games themselves: How do people make 'optimal' choices when these are contingent on what other people do?"[2] Game theory originated with the mathematician John von Neumann as early as 1928. The collaboration of von Neumann on theory and Oskar Morgenstern on applications to economic questions led to the seminal book *The Theory of Games and Economic Behavior* that first appeared in 1944, and was later revised in 1947 and 1953. Game theory is an approach to developing the best strategies in areas such as economics and war to beat a competitor or enemy. [Of course, one possible strategy is to convert an enemy into an ally, or a competitor into a partner!]

How do people make 'optimal' choices when these are contingent on what other people do?

A game is defined by a set of rules that specify the players, their desired goals, allowed interactions, and a method of assessing outcomes. There can be one or more goals with different levels of importance. The players adopt strategies, and the interactions of the "moves" based on those strategies lead to outcomes which may or may not be consistent with the players' goals. Complex games should involve look-ahead strategies that address the different possible moves that an opponent could make. It is important to try to understand an opponent's goals in order to maximize the probability of a favorable outcome. Games can be sequential, with player interaction allowed between moves.

[2]From Steven J. Brams, "Theory of Moves," *American Scientist,* **81**, 562-570, November-December 1993.

PROSPERITY GAME DESCRIPTION

Players - General

The number of teams employed depends on the game format and the number of players. In the AEA prototype, four teams were involved. Two Blue Teams represented presidential commissions empowered to develop and recommend policies to increase the competitiveness of US industries. Their primary goals are to simultaneously increase jobs (quantity and quality), profits, worker productivity, and national wealth (and corresponding tax revenues). They are composed of representatives from four US entities: industry, government, universities, and national laboratories. The Purple Team represents foreign interests and is composed of the foreign counterparts of the four entities. Their primary goal is to maintain or increase their market share. The Green Team represents the market or "reality"; its composition is as broad as required. The Green Team assesses the Blue and Purple recommendations against a set of criteria or metrics which they develop at the beginning of the game. Team deliberations are guided by *facilitators*, and *recorders* document the team decisions in the form of memoranda. *Analysts* independently observe and document the proceedings. A control team and director guide and monitor the overall game.

Mechanics - General

The game begins with a triggering event. In the AEA prototype, it was assumed that the President becomes deeply concerned that the US is inadequately positioned to take advantage of the growing demand for mass-marketed, information-related electronics. The President, with strong Congressional backing, appoints a committee (Blue Teams) empowered to make far-reaching recommendations for enhancing the success of the US electronics industry over the next ten to twenty years. Simultaneously, concerned about a possible US initiative, a competing foreign country convenes a high-level panel (Purple Team) to assess possible US moves and to develop counter strategies.

The Blue Teams recommend a policy framework and enabling strategies to achieve their goals. The Purple Team similarly develops its own policies. Memoranda proposed by these teams are assessed against criteria established by the Green Team. Interactions among the teams can be through the exchange of memoranda or through open plenary sessions. Based on this feedback, the Blue and Purple Teams may alter their own strategies to improve their chances of accomplishing their goals. The Green Team assesses the outcomes of the moves and countermoves. A final group session informs all players of the game highlights.

AEA PROTOTYPE GAME

The AEA prototype differed from the general game and the previous EIA game (q.v.) in several ways. More government players were involved, representing several federal agencies and offices (OSTP, NSF, NRL, NASA, EPA, DOE, ARPA, NWC) as well as congressional staffers and representatives from industry.

A President's Team was also added to supply feedback to the Blue and Purple Teams in plenary session. The duration of play was extended to one and a half days.

The Green and President Teams' assessments played a much more important role in this game. Several sessions were used to inform the Blue and Purple Teams of their assessments and scores. In contrast, the previous EIA game did not provide assessments during the game. These evaluations played a strong (and possibly demotivating) role in the game dynamics, and are discussed in the section on LESSONS LEARNED.

A comprehensive "Players' Handbook" was prepared and supplied to the players prior to the game. The "Innovator," an electronic polling device, was used to facilitate rapid voting on decisions and to capture results for subsequent analyses.

The team compositions are given in Appendix A. The agenda and schedule of play are shown in Appendix B. Detailed memoranda and analyses are provided in Appendix C. Graphical data estimating the future impact of the team strategies on the economy are presented in Appendix D. Appendix E provides the notes used by Michael Oppenheimer in his *Globalization* presentation.

Metrics

The Green Team provides two kinds of feedback on the Blue and Purple strategies: "qualitative" and "quantitative." Of course, both types of feedback are qualitative and subjective, depending on the Green Team's voting on the effectiveness and probable consequences of the strategies. The

"qualitative" feedback is generated by first developing a list of criteria for assessing the strategies; these criteria are assigned numerical relative importances from 1 (low) to 3 (high). The specific strategies are then assigned a score to estimate impact on each criterion. The sum of the products of importance times impact provides a single numerical score for each strategy.

The "quantitative" feedback involves estimating (by voting on a scale from 1 (low) to 5 (high) the effects of all of a team's strategies on four key metrics:

- Standard of living and tax revenues, as measured by: Gross Domestic Product (of which tax revenue is historically approximately 30%). Baseline annual growth was assumed to be 1.3% for the US, 2.0% for Purple countries.

- Innovation and competitiveness, as measured by manufacturing productivity, which reflects the conflict between reducing costs and increasing jobs. Improving worker productivity often reduces the number of jobs in a particular production industry, but reduces costs which increases profits. Innovation is involved in improving productivity and creating new products for both new profits and new jobs. Productivity was assumed to increase 3% per year in the US, 4.2% in Purple countries.[3]

- Jobs, as measured by: Consumer electronics production in factories within the United States regardless of country of ownership. The assumed "business-as-usual" annual growth rate was a very modest 0.5% in the US, and 3.0% in Purple countries.

- Profitability and market share, as measured by: Fractional value added to global production of consumer electronics by US-owned companies, regardless of location of production. We assumed a baseline projected increase of 1.25% per year for both the US and foreign companies.

More details on the qualitative and quantitative metrics are provided in the section on Green Team Analysis and Assessments.

RESULTS

Summary

The Blue and Purple teams developed their initial assumptions and recommendations in the first session. The subsequent two sessions allowed for revisions and refinements of this work, using the comments and assessments of the Green and President teams.

Blue I believed that a global economy is developing. A "technology explosion" was anticipated which would "restructure industry," dominate the 21st century, and create an enormous demand for industry. They developed three primary strategies:

A technology explosion will dominate the 21st century

1. Increase government/industry partnerships to create a national policy conducive to sustained industrial growth and competitiveness. This would include reassessing and restructuring fiscal, monetary, trade, regulatory, R&D, and tax

[3] Between 1980 and 1988, the manufacturing productivity of Japan and Germany increased 5.5% and 2.8% respectively; the average is 4.2%. Data from Paul A. Krugman, "Myths and Realities of US Competitiveness," *Science*, Vol. 254, p. 811, November 8, 1991.

policies, to create a climate favorable to domestic technology development and production.
2. Make low-cost, long-term capital readily available; this would include amending the Glas/Stegal Act to permit banks to provide equity financing to US corporations.
3. Develop a national technology delivery system, under industry leadership in partnership with government and academia. This system would also include work force education and training, and support for a national/international enhanced information infrastructure.

The low-cost long-term capital recommendation received the highest rating from the Green Team. The other two strategies also scored high.

Blue II focused on a polarized world that included regional conflicts and technology *haves* and *have-nots.* Their deliberations led to three primary recommendations:

1. Re-engineer government regulations so that they add value to national competitiveness; e.g., reduce export controls, stimulate industry consortia, streamline procurement practices, and emphasize outcome-based rather than prescriptive environmental regulations.
2. Shift investments from government-performed R&D to university and industrial R&D; consolidate the federal labs to serve defense needs.
3. Focus and catalyze education reforms.

The Purple Team assumptions and recommendations were extremely similar to the EIA prototype. Their objective was to build market share and profits. To accomplish this, they recommended pursuing policies they believed were already successful: Continue to exploit US openness; control high-tech tooling; promote US government regulations in ethics, accountability, environmental protection; support US role in world defense; acquire valuable US companies; concede nothing of value in trade negotiations; and use the US media to benefit Purple objectives.

The Purple Team was convinced of the correctness of its strategies. After receiving the Presidential Review Briefing, the Green Team assessment, and intelligence concerning the Blue strategies, the Purple Team responded similarly to the EIA game response: "We are not afraid of the Blue Teams; there is nothing there that frightens us. The situation is almost laughable. Both Blue Teams are wimpy."

Both Blue Teams are wimpy

However, deeply assuming their Purple roles, the team believed that they "needed to be more subtle." They did not want to give the impression that they were "going too far," or that they wanted "to damage the US."

A trade war should be avoided. Minor concessions were considered that could mollify the US; this might include locating more manufacturing in the US, and making a show out of increasing procurements on an industry to industry basis. Nevertheless, the primary strategy was still to skirt US trade concerns, e.g., by taking advantage of NAFTA (possibly by locating production in Mexico, but Purple did not elaborate). Although Purple would like to avoid a trade war, they were convinced that the US would lose.

The impact of the reviews and assessments on the Blue and Purple teams by the President and Green teams was modest at best, and ineffectual at worst. The changes in strategies were predominantly in form, rather than content. The teams adjusted the amount of

detail in their memoranda, or attempted to alter the tone.

In general, both the Blue and Purple teams seemed quite confident of their own strategies, and condescending toward the strategies of the "other country." Given this milieu, there was little motivation for the Purple and Blue teams to collaborate, since each thought their strategies would be independently successful. In the Presidential briefing, Blue I said that the "US is ahead. We are doing fine."

US is ahead. We are doing fine

Blue Team I

Blue I initially made the following assumptions:

1. Information infrastructure is critical.
2. There will be closer industry/government partnerships.
3. There will be a global economy.
4. There will be a technology explosion which will restructure industry, dominate the 21st century and create an enormous demand for industry.
5. There will be increasing world concern about environmental impact.

Based on these assumptions, the team concluded that a coherent national policy needed to be created and maintained to establish an environment conducive to industrial growth and competitiveness. The policy needed to include:

- Low cost readily available, long-term capital.
- A national technology delivery system and infrastructure through partnerships and cost-sharing between industry, government, and academia, including vision (roadmaps), identification and benchmarking of worldwide technologies, and acquisition and deployment of technology.
- Fiscal, monetary, trade, and regulatory policy.
- Support for national and international enhanced information infrastructure.
- Government partnering with specific industries targeted by foreign countries.

Three of these strategies were qualitatively assessed by the Green Team against their sixteen criteria (see Table II): Low-cost long-term capital (231.6); national technology delivery system (159.7); and an enhanced national/international information structure (150.2). The scores (in parenthesis) indicate that low-cost capital was very important, and the other two strategies were also important.

Technology is the primary engine of competitiveness, job formation,proactivity, and economic growth

In the second and third sessions, Blue I refined and modified their options and recommendations. An important new insight was that "Technology is the primary engine of competitiveness, job formation, proactivity, and economic growth in a hyper-competitive global marketplace with vanishing borders." The final recommendations emphasized three major strategies:

I. Increase government/industry partnerships to develop a means to create and maintain a coherent national policy to establish an environment (fiscal, monetary, trade, regulatory, etc.) conducive to sustained industrial growth and competitiveness. An important element of this policy is to keep industry in the US. To do this, we must:
   - Reassess and restructure tax policy with respect to value added vs.

corporate income tax to create a climate favorable to domestic technology development and production.
- Increase emphasis on harvesting basic research in manufacturing.

II. Make low-cost, long-term capital readily available. The President should:
- Charge the National Economic Council with reexamining the inflation/cost-of-capital paradigm to achieve this objective.
- Recommend the Glas/Stegal Act be amended to permit banks to provide equity financing to US corporations.

III. Develop a national technology delivery system, established under industry lead in partnership with government and academia which includes:
- Vision/roadmap development.
- Identification and benchmarking of worldwide technologies.
- Acquisition of technology.
- Deployment of technology.
- Lifetime work force education and training.
- Support for national and international enhanced information infrastructure.

The refinement of Blue I's strategies led to an increase in their impact on the four major metrics. The Green Team's assessment increased from an average of 3.89 to 4.07 (see Table IV). The largest increase in impact occurred for domestically owned production.

Blue Team II

Blue II began with a different set of assumptions:

1. There will be continual regional conflicts (wars).
2. Segregation of technology *have/have- nots* will continue.
3. National defense cannot be left to dynamics of free market place.
4. The bifurcated/bimodal world will continue to get worse.

These assumptions led to three primary recommendations:

I. Reduce non-value added regulations in export restrictions, environmental issues.

II. Shift investments from direct government-performed R&D to university and industrial R&D activities while maintaining core competence for defense-related requirements.

III. Focus and catalyze education reforms.

Blue II made no major changes in options or strategies over the next two sessions. Rather, they provided additional details on their original recommendations:

I. It should be the policy of this administration to re-engineer government regulations, so that they add value to national competitiveness, e.g.:
   a. Reduce export controls on widely available goods.
   b. Stimulate industry consortial activities through manufacturing stages.
   c. Streamline procurement practices and requirements.
   d. Emphasize outcome-based vs. prescriptive environmental regulations.

II. Shift investments from direct government performed R&D to university and industrial R&D activities while maintaining core competencies for defense-related needs in the government laboratories. Apply the savings to, e.g.:

a. Highly-leveraged tax incentives.
b. Catalytic, generic technology development (such as SEMATECH).
c. Replace research investments previously supported by defense-related activity with long-term basic university research.
d. Create a National Senior Scientists Corps to support educational initiatives.
e. Consolidate to several federal "corporate" laboratories to serve defense needs.

III. Focus and catalyze education reforms across the spectrum from pre-K through secondary, vocational training, and universities:
a. Convert federal involvement from prescriptive to empowering.
b. Incentivize business involvement and support of education, e.g. curriculum development, access to corporate training facilities, etc.
c. Encourage educational experimentation, e.g. market-based school selections, etc.
d. Increase national emphasis on science and technology education.
e. Stimulate use of NII and other advanced technologies in education.

The three strategies were qualitatively assessed by the Green Team against their sixteen criteria (see Table II): Reduce non-value added regulations (114.2); shift R&D funding from government to university and industrial activities (83.0); and focus on education reforms (167.8). The last strategy was the second highest rated of the six strategies evaluated. However, the other two recommendations received the lowest scores by the Green Team.

Although Blue II's strategies remained essentially unchanged, their scores on the four major metrics increased from an average of 3.00 after Session 1 to 3.54 after Session 2 (see Table IV).

Purple Team

Despite the presence of actual government and laboratory players, the Purple Team behaved in a manner very similar to the industry-dominated EIA Purple Team. The many similarities between the two teams were so striking that they could be presented as a "universal American view" of foreign competitors.

In both prototyping sessions, the industry, government and laboratory representatives on the Purple Teams were portrayed as wholly supportive of industry's position. Strategies involving subsidizing US universities, trade practices of questionable ethics, and promoting disinformation were not opposed by any of the Purple groups.

The team felt that Japan, China and Asia were the main competitors. Europe was considered "irrelevant." This differs from the EIA decision to represent Japan, France and the Netherlands as the main US competition. However, both teams actually behaved very similarly during the game; i.e., no consortium was ever represented. Rather, the players behaved as though they were representing a single, generic country (which they called a "composite"), which almost always was Japan. This behavior was so strong and consistent between the two prototypes that it should be accepted as a game rule. That is, the concept of representing a generic, single foreign country should be adopted as an initial assumption.

Many assumptions and strategies were identical to those voiced at the EIA game. In fact, there were only minor differences in topics and emphasis. The predominant view remained that current US laws, regulations, culture, and business practices all contribute greatly to the success of Purple countries. The key strategy was to support and encourage the existing US environment, and to continue to promote the current Purple policies (as perceived by the Team) in trade, market strategies, politics, obfuscation, and disinformation.

As at the EIA game, the Purple university and laboratory players made **no** attempt to defend or promote their educational systems or research facilities, vis a vis those in the US. There was also **no** opposition by the Purple government players to the unethical nature of the proposed trade, political or social tactics.

The adjective "high-value-added" was questioned when applied to high-technology products. In fact, the highest value added occurs for capital intensive products which are almost always basic commodities like cigarettes, autos, gasoline, steel. Electronics and aircraft are about average in terms of value added per worker.

Purple Team assumptions were developed during the first session and were never changed:

1. Purple team is driven by long-term market share and profits as a means to world power.
2. US openness policies of today will be continued (universities, industrial associations, etc.).
3. US continues to have conflict over social vs. economic priorities.
4. China will continue to grow and become a major manufacturing entity.
5. US continues to be world's policeman.

Purple generated a list of seven aggressive strategies (see Appendix C) that advocated continuing and strengthening the current "Purple" strategies. These strategies remained essentially unchanged through the three sessions, although they were ultimately refined into two categories, economic and political. Their final memorandum concluded:

"The Purple Team has decided to make no substantive changes to its strategies.
Maintaining current growth rates are sufficient to achieve our regions' objectives.
It is our intent to avoid trade wars by making minimal concessions as required.
We believe that the US has a great deal to lose if it were to initiate a trade war.
We are heartened by the Blue Teams' modest strategies.
We expect our long-term growth market to be dominated by the Pacific Rim".

1. <u>Economic Strategy</u>

A. Continue to exploit US openness of university and industry groups, labs (strengthen our weakness in innovation and avoid R&D costs).
   -- Fund US university/laboratory research
   -- Send more of "our" students to US
   -- Undertake more CRADAs/joint ventures with US companies
   -- Encourage US to fund universities
   -- Assure heavy participation from "our block" in US trade groups to influence US policy
   -- Propose international initiatives in Software
   -- Globalize the NII (e.g., encourage international standards body through US subsidiaries)

B. Control high-tech tooling by selling at low prices to gain market share.

-- Subsidize our domestic tooling industries.
-- Subsidize sales to US.
-- Label any US attempt to similarly subsidize as unfair trade practice.
-- Respond to US attempts to negate this activity by emphasizing division in industry groups.

C. Balkanize the states of US (gain political power through economic influence).
D. Acquire targeted US companies.

2. Political Strategy

A. Promote government regulations in US ethics and accountability.
-- Encourage US environmental regulations
-- Support US role as world's policeman
-- Fund law schools to create more attorneys
-- Fund minority and social organizations

B. Erect barriers to direct foreign investment.
-- Exploit inevitable human rights violations in China to slow most favored nation's status.

C. Influence US media.
D. Continue perceived "Japanese-style" of negotiating with US.
-- Slow negotiation, token concessions, crisis agreement and no real trade openings.
-- Develop series of strategies for obfuscating trade imbalances (e.g. use third nations as intermediaries).

E. Existence of trade block is disinformation. (This item simply recognized that Purple had behaved almost exclusively as a Japanese surrogate.)

The Purple Team's strategy of "business-as-usual" was the highest scoring strategy at the EIA game. However, the AEA Green Team refused to provide a qualitative assessment of the many Purple strategies, nor did they combine those strategies under the label of "business-as-usual."

The Green Team also gave the Purple Team low scores in the quantitative assessment of the impact on the four primary metrics (see Table IV). It is not clear why Green Team voting in this case differed so much from the EIA example.

The Purple Team was puzzled by the Green Team assessment. Did Green evaluate the effect of Purple strategies on the US economy, or on the Purple economy? What did the scores mean? Purple believed that "business-as-usual" meant that Purple wins – i.e., maintaining the present Purple growth rate would be sufficient to overtake the US.

Green Team Analysis and Assessments

Qualitative Assessments

The Green Team began its deliberations by

Technologies are built on a scientific base, shaped by the financial environment

reviewing the 11 qualitative criteria developed at the previous EIA Game (q.v.). They adopted 10 of those 11 criteria (dropping "Decreases Time To Market," and added 6 of their own. The final 16 criteria, their rank, and the assigned Quality Functional Deployment[4] (QFD) scores (from 1-low to 3-high) are shown in Table I. The equivalent data from the EIA game are also shown in the table.

[4]See, for example, James L.Bossert, *Quality Function Deployment*, ASQC Quality Press, Milwaukee, 1991.

Assessing the Assessors

The primary function of the Green Team, in its role as "marketplace," is to assess the strategies recommended by the Blue and Purple Teams against a set of criteria and metrics. However, since we have now conducted two prototype games with different Green Team players, we have the opportunity to compare the specific criteria and their relative importances assigned by the two independent EIA and AEA Green Teams; i.e., we can provide an assessment of the assessors, at least with respect to similarities and differences.

One striking agreement is the high importance both teams assigned to *encouraging capital investment*. This also agrees with the recent conclusions drawn by Robert Teitelman.[5] Teitelman concludes that the technoindustrial stage "is dominated by finance — its availability, cost and accompanying conditions. The role of money is repeatedly emphasized as the most influential variable in product development, manufacturing and marketing."[6] Teitelman says "[Technologies] are built on a scientific base, shaped by the financial environment." So far, at least, government, industry, academic and laboratory personnel consider financial incentives to be a very important strategy.

If QFD scores greater than 2.4 are defined to be "very important," then the EIA and AEA teams both agreed that *increasing GDP, promoting R&D innovation, accommodating the long term, and likely to increase jobs* were the most important criteria.

The EIA Green Team was composed almost entirely of industry representatives. The AEA Green Team had a much greater representation from government. This may partly explain the much higher importance assigned to profits by the EIA team. Although both teams considered *increasing jobs* important, the EIA team considered *increasing quality jobs* to be more important than the AEA team. Furthermore, although the EIA team felt that *decreasing time to market* was an important criterion, the AEA team felt that this was of no importance in assessing strategies.

[5] Robert Teitelman, *Profits of Science: The American Marriage of Business and Technology*, Basic Books, 1994.

[6] Daniel S. Greenberg's review of Teitelman's book in *Nature*, Vol. 368, p. 372-3, 24 March 1994.

TABLE I: GREEN TEAM QUALITATIVE ASSESSMENT CRITERIA

ASSESSMENT CRITERIA	RANK/AEA	QFD/AEA REL. IMPOR-TANCE	RANK/EIA	QFD/EIA REL. IMPOR-TANCE
Encourages capital investment	1,2,3	2.75	1	2.86
Likely to increase GDP (tax revenue without increasing tax rates)	1,2,3	2.75	7	2.43
Promotes R&D innovation	1,2,3	2.75	6	2.5
Accommodates the long term	4,5	2.5	3	2.64
Likely to increase jobs	4,5	2.5	4	2.57
Accommodates national security and foreign policy	6,7	2.38		
Quality of life (environment, education)	6,7	2.38		
Improve trade balance	8,9	2.25		
Accommodates global realities	8,9	2.25		
Likely to increase profits	10,11,12	2.13	2	2.71
Labor productivity	10,11,12	2.13		
Likely to increase quality jobs	10,11,12	2.13	5	2.5
Addresses fairness perception	13	2.0	10,11	1.5
Accommodates foreign cultural traits (moderately collectivist, strongly risk avoiding, weakly hierarchical)	14,15	1.75	10,11	1.5
Disposable income	14,15	1.75		
Accommodates US cultural traits (strongly individualistic, moderate in risk avoidance, moderately egalitarian	16	1.5	9	1.86
Decreases time to market	-	-	8	2.36

Qualitative Assessment of Blue Team Strategies.

Each component recommendation was assessed by the sum of the products of importance times the estimated impact of the recommendation on each criteria (1= little impact, 3= medium impact, and 9= strong impact) as is commonly done in the Quality Functional Deployment formalism [see footnote 3]. Each of the Blue Teams developed three strategies in the first session.

TABLE II: GREEN TEAM QUALITATIVE ASSESSMENT OF BLUE TEAM STRATEGIES

		BLUE I			BLUE II		
BLUE STRATEGIES →	**QFD/AEA relative import'ce ↓**	**Low-cost long-term capital**	**National Techn'lgy Delivery system**	**Support National Informa'n Infrastr'r**	**Reduce non-value added regulations**	**Shift fund-ing from gover'mnt to univ/ind.**	**Focus on education reforms**
ASSESSMENT CRITERIA ↓							
Encourages capital investment	**2.75**	**9.00**	**3.29**	**3.00**	**1.86**	**2.71**	**1.57**
Likely to increase GDP (tax reven. without increasing tax rates)	**2.75**	**7.29**	**4.43**	**4.50**	**3.86**	**2.71**	**3.57**
Promotes R&D innovation	**2.75**	**6.43**	**6.43**	**5.63**	**1.86**	**2.86**	**4.14**
Accommodates the long term	**2.50**	**9.00**	**6.43**	**5.63**	**4.14**	**3.29**	**8.14**
Likely to increase jobs	**2.50**	**7.29**	**4.43**	**4.50**	**2.43**	**1.29**	**5.00**
Accommodates national security and foreign policy	**2.38**	**3.29**	**5.00**	**2.50**	**1.29**	**1.71**	**2.14**
Quality of life (environ't, education)	**2.38**	**4.43**	**3.29**	**5.50**	**1.29**	**1.57**	**7.29**
Improve trade balance	**2.25**	**5.57**	**3.00**	**2.75**	**5.57**	**1.29**	**2.43**
Accommodates global realities	**2.25**	**7.00**	**6.14**	**6.50**	**6.71**	**1.57**	**7.00**
Likely to increase profits	**2.13**	**8.14**	**4.43**	**3.25**	**3.86**	**3.29**	**2.71**
Labor productivity	**2.13**	**5.29**	**4.14**	**4.88**	**2.71**	**2.43**	**6.43**
Likely to increase quality jobs	**2.13**	**8.14**	**5.29**	**5.00**	**2.14**	**1.29**	**6.71**
Addresses fairness perception	**2.00**	**4.14**	**3.86**	**2.88**	**3.29**	**3.00**	**5.57**
Accommodatesfor'n cultural traits (moderately collectivist, strongly risk avoiding, weakly hierarchical)	**1.75**	**5.57**	**2.43**	**2.88**	**3.86**	**2.71**	**3.86**
Disposable income	**1.75**	**6.14**	**2.71**	**2.25**	**3.00**	**1.29**	**5.00**
Accommodates US cultural traits (strongly individualistic, mod'te risk avoidance, moderately egalitarian.	**1.50**	**4.71**	**4.71**	**4.13**	**4.00**	**4.43**	**3.57**
QFD Score (Sum of import x impact)	**{35.9}**	**231.64**	**159.66**	**150.18**	**114.18**	**83.02**	**167.79**

The Green Team scored these strategies separately as shown in Table II.

The highest scoring strategies were low-cost, long-term capital, education reforms, a national technology delivery system and support for the National Information Infrastructure (NII), in that order. The lowest scoring strategies involved shifting funds from government R&D to industry and universities, and reducing regulations. Despite these latter two low scores which were reported early in the game, Blue II did not alter these strategies nor change their relative priorities.

Quantitative Assessments

Simulated quantitative feedback was constructed for the four major metrics and their baseline expected changes for US "business as usual" (in brackets): Standard of living as measured by the Gross Domestic Product (GDP) [1.3%]; Competitiveness as measured by worker productivity [3%]; US jobs as measured by domestically located production [0.5%]; and profits accruing to domestically owned production regardless of location [1.25%]. In addition, three derivative metrics were developed: total employment in the electronics industry [-2.5%]; increase or decrease in tax revenue; and taxpayer return on investment.

These baseline percentages are estimated from the actual rates of change over the last twenty years. However, projections are highly uncertain. Deviations from these expectations were estimated to cover the ranges shown in Table III. The ranges were divided into five parts. The Green Team provided subjective estimates on a scale of 1 to 5 (1 = very unfavorable to 5 = very favorable) of the degree to which the recommendations would impact the four metrics. The average of these subjective rankings were converted into expected annual growth rates for each of the four primary metrics shown in Table III.

The Green Team also estimated how many years of incubation (or delay) would be required before the strategy took effect. These qualitative judgments on a scale from 1 to 5 were translated into years as shown in Table III.

It is often difficult to find or reconcile different sets of data. For example, domestic production is only one factor in producing jobs. Increasing worker productivity tends to decrease jobs if market demand remains unchanged. That is, the total number of electronics jobs could be estimated by dividing domestic production by worker productivity:

$$\frac{\$330\text{B/year}}{\$240{,}000 \text{ produced per worker/year}} = 1.4 \text{ million electronics workers.}$$

But the AEA estimated that there were between 1.9 and 2.3 million workers in the electronics industry in 1992, depending on whether software and programming were included.[7] Their charts covered the years from 1988 to 1992. If the decrease continued similarly through 1994, we would expect the number of jobs in the electronics industry would be decreasing from 5-8% a year, and the number of jobs in 1994 would be between 1.6 and 2.1 million.

[7] "An industry - and a nation - at risk," report prepared by the American Electronics Association, November 1992.

TABLE III: GREEN TEAM QUANTIFICATION OF BLUE TEAM ESTIMATES

METRIC	ANNUAL % RATE OF GROWTH FOR RESPONSES 1 THROUGH 5				
	1	**2**	**3**	**4**	**5**
Standard of living and tax revenue: Gross Domestic Product. Currently $24,000/capita in US.	-0.5	0.4	1.3	2.2	3.1%
{$22,000/capita for Purple}	{-0.8	0.6	2.0	3.4	4.8%}
Innovation & Competitiveness: Productivity. Currently $240,000 sales/worker.	1.0	2.0	3.0	4.0	5.0%
{$220,000 sales/worker for Purple}	{1.4	2.8	4.2	5.6	7.0%}
Jobs: Production on US soil, regardless of ownership. Currently $330B/year.	-3.5	-1.5	0.5	2.5	4.5%
{$300B/year for Purple}	{0.5	1.75	3.0	4.25	5.5%}
Profits: Fractional value added by US companies anywhere. Currently $230B/year.	-1.25	0	1.25	2.5	3.75%
{$210B/year for Purple}	{-1.25	0	1.25	2.5	3.75%}
Years Until Impact (Incubation period)	1	3	5	7	9 years
Total number of electronics workers. Current estimate is 2 million.	-7.5	-5.0	-2.5	0	2.5%
{1.8 million for Purple}	{0.5	1.75	3.0	4.25	5.5%}

In Table III, we compromised to allow for approximate consistency among the data. Hence, the baseline number of jobs in electronics was projected to decrease by 2.5% per year in the absence of different strategies; the 1994 starting point was assumed to be 2 million jobs in the US (1.8 million in the Purple country, but increasing at the rate of 3% per year). Since the Green Team did not vote directly on electronics employment as a metric, we used the same average as provided for domestic production. (This assumes the simplification of constant productivity.)

The percentage changes applied to the Purple Team represent approximate historic trends for Asian and European countries, but especially Japan and Germany. To provide a basis for

comparison between the fictitious (but representative) Purple country and the US, we assumed that their starting economic points represented about 90% of the US equivalents. Given their larger rates of increase, the calculations would allow an estimate of the year in which the Purple GDP, domestic production, (etc.) surpassed that of the US for the baseline assumptions.

A sample calculation might be useful in elucidating the procedure. Seven Green Team players voted as follows for domestic production and incubation:

	1	2	3	4	5	Average
Domestic production:	**0**	**0**	**0**	**6**	**1**	**4.1429**
Incubation Period:	**0**	**1**	**3**	**2**	**1**	**3.4286**

Using the functional mapping shown in Table III, the mean percentage increase in domestic production would be 2(4.143-2.75) = 2.79%. The delay would be 2(3.429-0.5) = 5.86 years which would be rounded to 6 years in the calculation. The derived mean number of electronics jobs would be calculated to increase by 2.5(4.143-4) = 0.36%.

The two additional derived metrics address expected tax revenues, and return on taxpayers' investments.

The total tax revenue from the consumer electronics activity is estimated from the projected Gross Domestic Product (GDP) per capita, times 4.5 — the total number of jobs associated with the economic activity arising from consumer electronics, times the population per worker (assumed to be 2), times the ratio of the nation's tax revenue to the GDP (0.30). The estimate does not include the loss in tax revenue elsewhere in the economy because of the investment of funds into consumer electronics rather than another activity. If properly done, the loss in other activities should be minimal. The same calculation is done for the baseline case and subtracted from the advocate's case to estimate the effect the recommendation might have on total tax revenues. This calculation lets players estimate the expectation for return on the investment from the public.

Most teams estimated no additional cost for their strategies; in that case, there would be no payback time. Hence, the return on investment begins as soon as the new strategy kicks in, i.e., after the initial delay period. A discounted cash flow analysis was performed to estimate how much the taxpayers would receive as a result of the improved GDP. Because of the other desired effects (like jobs arising from the investment), the taxpayer is assumed to provide this patient capital at a 4% discount rate. Inflation is set to zero in the game. The net benefits are calculated for the recommended $0B per year case. To estimate the effects of a net cost to the public of five billion dollars per year to carry out the recommended strategies, an additional curve is plotted with this assumed public investment.

The quantitative metrics for all the Blue and Purple team deliberations are plotted in Appendix D. To indicate the ranges of the subjective estimates, we estimated the deviation of the means of an "infinite population of Green Teams." For a large number of Green Team players, the use of two standard deviations above and below the sampled mean would provide 95% confidence

that any other Green Team would produce a mean within this range. However, because of the small number of players (seven), the use of two standard deviations only provides a 90% confidence level. [For n=7, t=1.943 provides 90% confidence.] The mean values of the Green Team subjective predictions and the upper and lower bounds are also plotted in Appendix D.

Table IV provides the impact assessments for the four primary metrics for the Blue and Purple Teams.

Table IV shows that the Blue Team scores tended to increase in the second session, implying that the initial Green Team assessments led to "improved" strategies. However, the Purple Team did not change its strategy in the second session. The Blue teams also did not make major modifications to the content of their strategies, although the form and the level of detail were changed.

TABLE IV: GREEN TEAM ASSESSMENTS OF THE IMPACTS ON THE FOUR PRIMARY ECONOMIC METRICS

	Blue I		Blue 2		Purple
	Session I	Session II	Session I	Session II	Session I
Gross Domestic Product	**4.00**	**4.13**	**3.29**	**3.63**	**3.14**
Worker Productivity	**3.86**	**4.13**	**3.00**	**3.75**	**3.14**
Domestically Located Production	**4.14**	**4.00**	**3.14**	**3.38**	**3.00**
Domestically Owned Production	**3.57**	**4.00**	**2.57**	**3.38**	**3.43**
Average scores	**3.89**	**4.07**	**3.00**	**3.54**	**3.18**

The metrics plotted in Appendix D were based on the historic baselines discussed in the sections on Metrics and Green Team Quantitative Assessments. Table V shows the calculated projections of the strategies of the Blue and Purple teams after twenty years.

The results shown in Table V are rather remarkable, considering the relatively low scores assigned to Purple by the Green Team. The Purple standard of living was only exceeded by Blue I, but it equaled or exceeded the Blue II strategies in both sessions. Purple productivity and domestically located production exceeded that of both Blue Teams. Consumer electronics jobs and tax revenues exceeded Blue projections by about a factor of two. Only the better Blue strategies resulted in larger domestically owned production than in the Purple country.

Also note that in all cases, Blue jobs in consumer electronics decreased from their

TABLE V: GREEN TEAM 20-YEAR PROJECTIONS OF THE RESULTS OF APPLYING BLUE AND PURPLE STRATEGIES

	Blue I		Blue 2		Purple
	Session I	Session II	Session I	Session II	Session I
Gross Domestic Product	**$34.7K**	**$35.3K**	**$31.7K**	**$33.1K**	**$33.1K**
Worker Productivity	**$472.6K**	**$490.0K**	**$420.8K**	**$465.8K**	**$493.8K**
Domestically Located Production	**$497B**	**$488B**	**$378B**	**$406B**	**$526B**
Domestically Owned Production	**$321B**	**$350B**	**$273B**	**$309B**	**$288B**
Jobs in Consumer Electronics	**1.85M**	**1.81M**	**1.30M**	**1.43M**	**3.16M**
Tax Revenue	**$174B**	**$172B**	**$111B**	**$127.7B**	**$281B**

assumed two million jobs in 1994; Purple jobs almost doubled in the same twenty-year period.

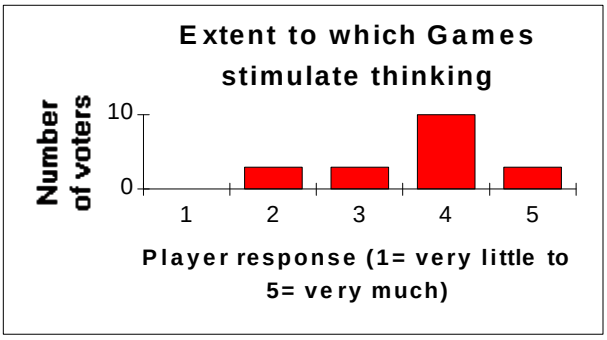
Hence, the projections imply that, in the estimation of the Green Team, the best of the Blue strategies were not likely to turn around the decrease of American competitiveness, relative to the Purple country, as measured by these metrics. Similarly, despite a comparatively low estimate of the efficacy of the Purple strategies, those strategies are predicted to serve the Purple country well in the next two decades.

This entire process remains subjective in that it depends on the collective judgments of the Green, Blue, and Purple teams. However, the projections allow the players to see some of the possible consequences of their recommendations and assumptions

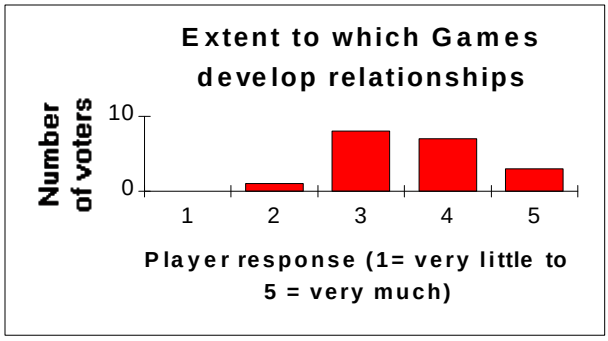
GAME EVALUATION BY AEA PLAYERS

Since Prosperity Games are tailored for specific customers with specific objectives, we plan to continuously evaluate our progress in meeting customers' expectations and striving for continuous improvement.

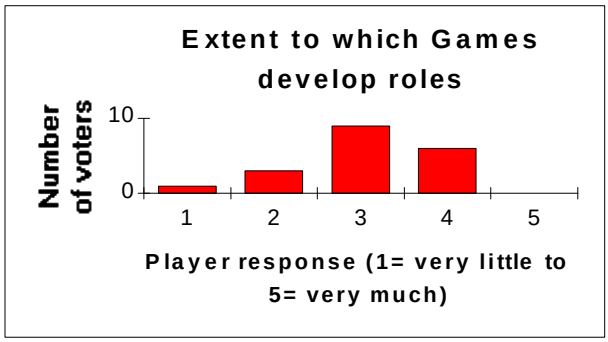
To the question addressing the extent to which the game stimulated thinking on technology policy, 13 of 19 voters scored a 4 or 5 (on a scale from 1= very little to 5= very much). The average score was 3.68± 0.95.



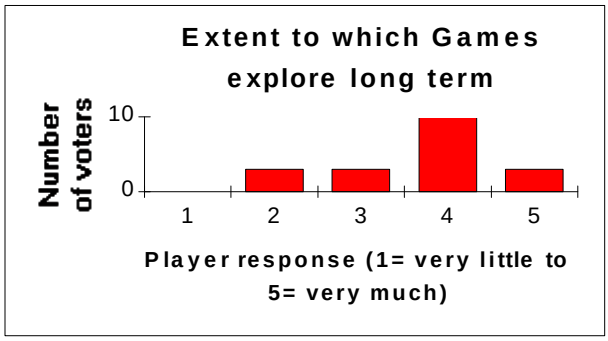
To the extent that the game facilitated the development of personal relationships that would help in the subsequent development of technology policy, the players assessed an average of 3.63± 0.83.



To the extent that the games developed an understanding of the roles, relationships, and interactions among the four identified groups, the players assessed an average of 3.17 ± 0.85.



To the extent that the game explored the importance of using a long-term (10-20 years) horizon when thinking about and crafting policy, the players' assessment was 3.68 ± 0.95.



To the extent that the game laid the foundation for making a road map with the electronics industry, the players average assessment was 2.5 ± 1.12. This score was significantly lower than the corresponding assessment at the EIA game. Since an important objective of the upcoming ESC-sponsored game is to assist in the roadmap-making effort, improvement is needed.

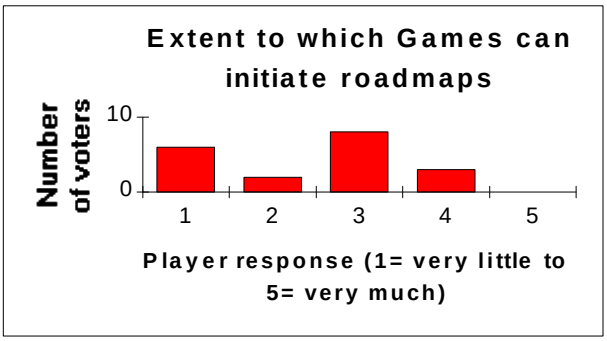


Table VI summarizes the average scores on the exit poll questions from both this AEA prototype and the previous EIA-sponsored game. In general, the scores were lower indicating the need for improvement. Two areas need special attention: the link to roadmap making, and the game format.

The differences in scores may reflect to some extent the differences in the composition of the players in the AEA game. These players were heterogeneous with 29% from industry, 43% from government, 14% from labs, and 14% from the academic/expert community. In contrast, the EIA game players were 92% from industry, 2% from government, 4% from labs, and 2% from the academic/expert community. However, improvement is clearly possible and needed.

In spite of the lower scores in the AEA game, the desire to play a full 2-day game with peers was higher for the AEA game than the EIA game. The helpfulness of the game staff was acknowledged and appreciated by the AEA players with a very high score.

TABLE VI: AVERAGE EVALUATION SCORES FOR THE AEA AND EIA PROTOTYPE GAMES

QUESTION	EIA	AEA
Stimulated thinking on future technology policy.	4.07	3.68
Facilitated development of relationships among players.	3.81	3.63
Developed roles and relationships among players.	3.33	3.05
Explored long-term thinking and planning.	4.02	3.68
Laid foundation for industry to make a technology roadmap.	3.70	2.42
Would you play a full 2-day game with peers from the 4 groups?	3.74	3.95
Would you recommend that technology policy makers play a 2-day game?	4.31	4.16
Format of the games?	3.31	2.68
Innovator decision aid?	4.12	4.05
Players' Handbook?	2.87	3.00
Inbriefing?	3.30	3.05
Wrap-up?	3.55	3.00
Prosperity Game staff helpfulness?	4.09	4.53
To what extent were you able to play your assigned role effectively?	2.96	3.11
To what extent did the players control the content?	4.38	4.42

LESSONS LEARNED

After the game, the staff and several players were polled for their analysis of the game, and suggestions for improvements. As with most situations involving two or more people, unanimity on lessons learned was not achieved. The written comments of 13 reviewers (80 pages) were synthesized into 127 recommendations, many of which were contradictory. These 127 were further discussed and refined in a meeting with the facilitators, analysts and control staff. Following are the primary recommendations for improving future games:

1. Players:

- Add experts on foreign business and government, Asia, Japan, China, and International Competitiveness, to the Purple Team.
- Consider the future use of Japanese players on the Purple Team. However, American economic/political experts on Japan, China, and Asia will be actively sought.
- Seek greater diversity for team members.
- Include more Congressional Staffers.
- Maintain approximately equal numbers of government and industry players.
- Include qualified, articulate academic and laboratory people.

2. Green Team:

- Develop metrics, criteria and sample feedback prior to game, and distribute as game homework with the Players' Handbook. Limit criteria to 7-10.
- Green Team feedback must be insightful, non-judgmental, and be presented well. Team should avoid the appearance of lecturing, judging or talking down to the Blue and Purple teams. Goal is to maintain enthusiasm and push for improved and more detailed strategies.
- Green Team players silently and unobtrusively observe the deliberations of Blue and Purple Teams.
- Green Team assesses Purple against same criteria and numbers as Blue Teams; i.e., how well the Purple country economy leads or lags the US.

3. Purple Team:

- Facilitator informs the team that it represents a generic foreign country.
- Purple Team provided with synopsis (in Handbook Supplement) of previous games' strategies.
- Use two Purple Teams.
- Use experts or real foreign nationals.

4. President Team:

- Acts only as US President.
- Purple strategies are presented as an intelligence briefing by a Purple Team member acting as an intelligence agent.

5. Blue Team:

- Blue Teams provided with synopsis (in Handbook Supplement) of previous games' strategies.

6. Players' Handbook and Supplement:

- Provide Green Team criteria and sample feedback package.
- Add more data on competitiveness, electronics data, high-value-added industries, justification for the primary event (jobs, GDP, profits, productivity, etc.) in Players' Handbook Supplement.
- Provide synopses of previous games' strategies in Players' Handbook Supplement.

7. Game Format:

- Use Innovator wisely; OK to prevent a player from dominating discussion; not OK to suppress minority opinions.
- Use hand voting to show importance, Innovator to measure degree of agreement.
- Develop written guidelines for Innovator use.
- Provide wall charts of key data related to metrics and electronics in the team deliberation rooms.
- Extend games to 1½-2 days with evening social/dinner/briefing the night before.
- Green and President Team members sit in Blue and Purple sessions and observe silently.
- Develop written guidelines for facilitators and analysts.
- Consider the introduction of a second event (political or economic event, or a technology breakthrough) to stimulate the game at midsession.
- Consider the switching of players to broaden perspectives and prevent arrogance and hardening of positions.
- Consider the introduction of an "Economic Summit." Further develop the "Summit" concept including starting point, terms and conditions, political and economic outcomes.

- Consider two possible presentations of about 30-60 minutes. One could be an invited presentation from a Japanese or American speaker on Japanese views on industrial competitiveness. Economics Professor Takatoshi Ito from Tokyo University was suggested. The topic could be "kyosei," i.e., symbiosis or "living in peaceful economic harmony with the world." The second speaker could discuss globalization.

ACKNOWLEDGMENTS

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We are especially indebted to Mr. Dick Iverson, President of the AEA, and Dr. Lance Glasser, Chairman of the ESC, for their encouragement and leadership for these games.

The AEA prototyping required a wide range of expertise. Of 22 support staff, 14 were from Sandia National Laboratories, 1 from the US Naval War College, 1 from Lawrence Livermore, 1 from De La Porte Associates, and 5 National Laboratories special consultants. The AEA and Sandia invited 25 players from industry, government, universities and national laboratories. All players and staff committed themselves to the success of this game, and their efforts are greatly appreciated.

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APPENDIX A

List of participants, facilitators, recorders, analysts and directors for the Prosperity Games Prototype with the American Electronics Association held on March 8-9, 1994 in Washington DC

Team	Role	Name	Company	Position
Blue I	Industry	Dr. Allen Rosenstein	Pioneer Magnetics	Chief Executive Officer
Blue I	Industry	Dr. Bruce Merrifield	American Electronics Association	Consultant
Blue I	Industry	Dick Thayer	AT&T	Director of Gov. Affairs
Blue I	Government	John Gerhart	Sen. Bingaman	Staff, Industrial Competitiveness
Blue I	Government	Tom Russell	NIST/Electronics&Elect. Eng'g Lab	Mgr/Optical Computing Coop./Prog Progs.
Blue I	Government	Kerry Hanson	OSTP/Exec. Office of the President	AAAS-Sloan Fellow
Blue I	Lab Director	Dr. Paul Peercy	Sandia National Laboratories	Dir./Microelectronics & Photonics
Blue I	Facilitator	Dr. Don Schroeder	Sandia National Laboratories	Program Manager
Blue I	Analyst	Dr. Gordon Longerbeam	Lawrence Livermore National Lab.	Asst. to Lab. Associate Director
Blue I	Recorder	Alex Ryburn	Sandia National Laboratories	Staff Secretary/Admin. Asst.
Team	**Role**	**Name**	**Company**	**Position**
Blue II	Industry	R. M. (Mike) Lockerd	Texas Instruments	Vice President/Corporate Staff
Blue II	Industry	Peter N. Smith	Raychem Corp.	Director, Federal Affairs
Blue II	Government	Dr. F. T. Knickerbocker	DOC	Electrical & Communications Sys.
Blue II	Lab Director	Dr. Gerald Borsuk	Naval Research Laboratory	Super./Elec. Science&Tech. Div.
Blue II	University/Expert	Dr. John E. Wood	University of New Mexico	Prof/Dept. of Mech. Engineering
Blue II	Facilitator	Dr. David Williams	Sandia National Laboratories	Dept. Mgr./Program Development
Blue II	Analyst	Dr. David Strip	Sandia National Laboratories	Dept Mgr./Intel. Sys. Princ. Dept.
Blue II	Recorder	Connie Nenninger	Sandia National Laboratories	Secretary/Conference Coordinator
Team	**Role**	**Name**	**Company**	**Position**
Purple	Industry	Dick Iverson	AEA	President
Purple	Industry	Jon Englund	AEA	Director/Tech. & Govt. Bus. Policy
Purple	Government/Ind.	Phillip (Phil) Lee Milstead	NASA	Tech. Mgr.Hi Perf.Comp./Comm Comm.
Purple	Government	Dr. Ivan (Skip) Berry	NSA Microelectronics Res. Lab	Tech. Transfer/Project Leader
Purple	Government	Lance Glasser	ARPA	Dir.,Elect. Systems Tech. Office
Purple	Government	Charles (Chuck) Fowler	DOE	Deputy Prog. Mgr./Tech. Transfer
Purple	University/Expert	Jim Gover	IEEE/Sandia National Laboratories	Gov.t Relations Staff Member
Purple	Facilitator	Dr. Jim Jorgensen	Sandia National Laboratories	Dept. Mgr./Info. Components Mfg'g.
Purple	Analyst	Dr. Marshall Berman	Sandia National Laboratories	Dept. Mgr./Innovative Tech. Appl.
Purple	Recorder	Betty Fleming	Sandia National Laboratories	Administrative Assistant
Team	**Role**	**Name**	**Company**	**Position**
President	Industry	Dick Iverson	American Electronics Association	President and CEO
President	Government-Exec.	Dr. Lance Glasser	ARPA	Director, ESTO
President	Government-Legis.	Patrick VonBargan	Senator Bingaman	Chief of Staff
Team	**Role**	**Name**	**Company**	**Position**

Green	Team Leader	Ron Lehman	Lawremce Livermore Nat'l Lab	Assistant to the Director
Green	Co Team Leader	Al Bottoms	Game Consultant	Retired, Navy; Consultant
Green	Industry	Robert DeHaven	Quality Systems Inc.	President and CEO
Green	Government	Paul J. Werbos	National Science Foundation	Prog. Director/Engineering Systems
Green	Government	Dr. Jane (Xan) Alexander	ARPA	MTO
Green	Lab Director	Dr. Dan Prono	Los Alamos National Laboratory	Manager, Strategic Planning
Green	University/Expert	Michael Oppenheimer	Inter Matrix	Gaming Consultant
Green	University/Expert	Dr. Bob Post	Consultant	Gaming Consultant
Green	Facilitator	Bill Moye	De La Port Associates	Senior Consultant
Green	Analyst	Kenneth R. McGruther	Innovative Futures Corporation	President
Green	Recorder	Theresa Apodaca	Sandia National Laboratories	Administrative Assistant
Team	**Role**	**Name**	**Company**	**Position**
Control	Game Director	Dr. Pace VanDevender	Sandia National Laboratories	Director, Nat'l Industrial Alliances
Control	Co- Game Director	Bud Hay	Naval War College	Director, Advanced Concepts Dept.
Control	Game Manager	Jake Lujan	Sonalyst, Inc.	Gaming Consultant
Control	Innovator Tech.	Adrian Gurule	Sandia National Laboratories	Member of the Technical Staff
Observer	Observer	Marie Garcia	Sandia National Laboratories	Strategic Planning Staff Member
	Observer	Caroline S. Wagner	Critical Technologies Inst./RAND	Senior Policy Analyst
Control	Recorder	Marylee Adams	Sandia National Laboratories	Staff Secretary

APPENDIX B: AGENDA AND SCHEDULE OF PLAY
Schedule for Wednesday, March 9, 1994

	Breakdown into Working Groups/Introductions			
Time	Blue 1 (Room 1)	Blue 2 (Room 2)	Purple (Room 3)	Green(11th Floor Conf. Rm)
08:00-09:15	•Group in-Brief (15 min) •Generate Strategy - Define Assumption (20 min) - Develop Options and Vote (20 min) - Prepare Recommendations (20 min)	•Group in-Brief (15 min) •Generate Strategy - Define Assumption (20 min) - Develop Options and Vote (20 min) - Prepare Recommendations (20 min)	•Group in-Brief (15 min) •Generate Strategy Document - Define Assumptions (30 min) - Prepare Strategy to gain marketshare (30 min)	•Review/Modify Criteria •Walk-Through Assessment Process
09:15-09:45	•Edit Action Memo 1 assembled from bullets (word-smithing) •Output: Action Memo 1	•Edit Action Memo 1 assembled from bullets (word-smithing) •Output: Action Memo 1	•Edit Foreign Competition Strategy against Blue •Output: Purple Team Strategy Document	•Visit Blue and Purple Team Groups to Observe
09:45-10:00	Break: (Print, Reproduce, and Deliver Action Items and Strategy Document to Green Team)			
10:00- 10:30	•Receive Briefing: "Globalization" -- Michael Oppenheimer -- Room 1			•Receive Draft Blue Action Memos/Purple Strategy •Discuss for understanding
10:30-11:30	•Presidential Review Briefings -- Room 1 - Blue 1 and Blue 2 Brief Recommendations - Purple Team provides "Foreign Economic Plan" - Green provides representatives able to question only - Presidential Review Panel Provides Comment and Direction - Presidential Review Panel Raises Issues			•Vote on criteria satisfaction for each recommendation
11:30-12:00	Review/Modify Action Memorandum	Review/Modify Action Memorandum	Review/Modify Strategy Documents	Green Team Working Lunch
12:00-12:30	Blue/Purple Team Lunch -- Cafeteria (Print, Reproduce, and Distribute Modified Action Items and Strategy Document to Green Team)			•Incorporate Blue and Purple Team Modifications into voting if needed
12:30-01:00	Blue/Purple Team Receive Briefing Concerning Green Team Criteria -- Room 1			•Break into subteams and prepare Assessment Brief

SCHEDULE FOR WEDNESDAY, MARCH 9, 1994 (CONTINUED)

	Breakdown into Working Groups/Introductions			
Time	Blue 1 (Room 1)	Blue 2 (Room 2)	Purple (Room 3)	Green 11th Floor Conf. Rm)
01:00-02:00	Green Team Briefs Assessment and Outcome of Major Economic Events -- Room 1			
02:00 03:00	•Modify Action Memos/ Prepare Counter Strategies -Develop Options and Vote (20 min) -Prepare New Recommendations (20 min) •Output: Action Memo 2 (20 min)	•Modify Action Memos/ Prepare Counter Strategies -Develop Options and Vote (20 min) -Prepare New Recommendations (20 min) •Output: Action Memo 2 (20 min)	•Revise Strategy (20 min) •Consider Options to Co-operate with Blue (20 min) •Output: Revised Strategy (20 min)	Attend Blue and Purple Team Meetings to Acquire Insight into Revised Strategy
03:00-03:15	Break: (Print, Reproduce, and Deliver Action Memos and Revised Strategy to Green Team)			
03:15-03:45	•Presidential Review Panel Examines New Strategies -- Room 1 •Presidential Review Panel Provides Comments and Direction •Green Team Provides Representatives able to Question Only			Green Team Prepares Assessment and Incorporates Presidential Review Comments as Time Permits
03:45-04:15	Game Critique With Blue Teams 1 and 2 and the Purple Team -- Room 1			Green Team Prepares Assessment and Incorporates Presidential Review Comments as Time Permits
04:15-05:00	Green Team Presents Final Assessment and Closing Critique -- Room 1			

APPENDIX C

Action Memoranda and Analysis for the Blue and Purple Teams

First Memorandum to the President for Blue Team I

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on digital consumer electronics.

Assumptions:

1. Information infrastructure is critical.
2. There will be closer industry/government partnerships.
3. There will be a global economy.
4. There will be a technology explosion which will restructure industry, dominate the 21st century and create an enormous demand for industry.
5. There will be increasing world concern about environmental impact.

Options:

1. There should be a major government support for technology infrastructure, including but not limited to R&D, education, and major facilities.
2. Readily available low-cost capital.
3. Technology delivery system.
4. Government may partner with specific industries targeted by foreign countries.
5. Major government emphasis on information infrastructure.

Recommendation(s) (Group into three or less for assessment):

I. Develop means to create and maintain a coherent national policy to establish an environment conducive to industrial growth and competitiveness. This policy must include:
   - Low cost readily available, long-term capital.
   - National technology delivery system and infrastructure through partnerships and cost-sharing between industry, government, and academia, including vision (roadmaps), identification and benchmarking of worldwide technologies, acquisition of technology, deployment of technology.
   - Fiscal, monetary, trade, and regulatory policy.
   - Support for national and international enhanced information infrastructure.
   - Government partnering with specific industries targeted by foreign countries.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years:

First Memorandum to the President for Blue Team I (Modified)

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on digital consumer electronics.

Assumptions:

1. Information infrastructure is critical.
2. There will be closer industry/government partnerships.
3. There will be a global economy.
4. There will be a technology explosion which will restructure industry, dominate the 21st century and create an enormous demand for industry.
5. There will be increasing world concern about environmental impact.

Options:

1. There should be a major government support for technology infrastructure, including but not limited to R&D, education, and major facilities.
2. Readily available low-cost capital.
3. Technology delivery system.
4. Government may partner with specific industries targeted by foreign countries.
5. Major government emphasis on information infrastructure.

Recommendation(s) (Group into three or less for assessment):

I. Develop means to create and maintain a coherent national policy to establish an environment conducive to industrial growth and competitiveness. This policy must include:
   - Low cost readily available, long-term capital -- the President should charge the National Economic Council with reexamining inflation/cost of capital paradigm with objective of making sustained low-cost capital readily available (repeal Glas/Stegal Act to permit banks to invest in capital equipment).
   - National technology delivery system and infrastructure through partnerships and cost-sharing between industry, government, and academia, including vision (roadmaps), identification and benchmarking of worldwide technologies, acquisition of technology, deployment of technology.
   - Fiscal, monetary, trade, and regulatory policy.
   - Support for national and international enhanced information infrastructure.
   - Government partnering with specific industries targeted by foreign countries.
   - Keep industry in US
     - Reassess tax policy with respect to value added vs. corporate income tax.
     - Increase emphasis on harvesting basic research in manufacturing.
     - Develop information infrastructure.
     - Develop information technology delivery system.

Second Memorandum to the President for Blue Team I

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on digital consumer electronics.

Assumptions:

1. There is a global economy.
2. Technology is primary engine of competitiveness, job formation, proactivity, and economic growth in a hyper-competitive global marketplace with vanishing borders.
3. There will be a continuing technology explosion which will restructure industry, greatly increase the standard of living, dominate the 21st century.
4. Therefore, in order to be competitive in the international marketplace, the US needs a national technology delivery system that is equal to or better than its competitors. A critical element of this is a global information system infrastructure.

Recommendation(s) (Group into three or less for assessment):

I. Increase government/industry partnerships to develop a means to create and maintain a coherent national policy to establish an environment (fiscal, monetary, trade, regulatory, etc.) conducive to sustained industrial growth and competitiveness. An important element of this policy is to keep industry in the US To do this, we must:
   - Reassess and restructure tax policy with respect to value added vs. corporate income tax to create a climate favorable to domestic technology development and production.
   - Increase emphasis on harvesting basic research in manufacturing.

II. Make low-cost, long-term capital readily available. The President should:
   - Charge the National Economic Council with reexamining the inflation/cost-of-capital paradigm to achieve this objective.
   - Recommend the Glas/Stegal Act be amended to permit banks to provide equity financing to US corporations.

III. Develop a national technology delivery system, established under industry lead in partnership with government and academia which includes:
   - Vision/roadmap development.
   - Identification and benchmarking of worldwide technologies.
   - Acquisition of technology.
   - Deployment of technology.
   - Lifetime work force education and training.
   - Support for national and international enhanced information infrastructure.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years: Guess at 0 to $15B.

Blue Team I -- Analyst's Report

General Comments:

Whereas the first game at Palm Springs with EIA seemed somewhat relaxed, and there was time for development of concepts, this one seemed more rushed and time-constrained. My guess is that three days of concentrated play is going to be required for real effectiveness. The game at Palm Springs was heavily tilted toward industry, with little effective representation from government, universities or laboratories. This one seemed somewhat the opposite, with strongest representation seeming to come from government or people with heavy government or government policy experience. The result for the second game seemed to be less coherence, and perhaps greater chaos with less time for convergence. That is not to say that either game was ineffective. I found the Palm Springs game to be very illuminating with regard to the problems faced by the industry. Similarly, I found the AEA game in Washington to clearly demonstrate the difficulty in resolving policy issues where government and industry interests overlap.

Both games were effective in building the base for more industry/laboratory cooperation, and for design of future games. Preparation for and management of the games were done very well. In terms of overall effectiveness, I found the first game to be more useful, simply because there was more time, and there was much stronger industry representation.

In terms of lessons learned, I would say the following. Provide for at least three days of play, and away from Washington if possible. Pick the game participants and players carefully to ensure they can truly represent the role to which they are assigned, and preferably that role should be as close as possible to their real one. Be up-front with the participants that this will be serious and time consuming, and that we expect and hope that the results will actually have an influence in future government programs and budgets, and get that commitment from the appropriate government representatives. And while hard work and time will be required, allow time for socializing, getting acquainted, and having a good time.

Analysis, Blue Team I:

Blue Team I had some very impressive people, but the balance was shifted heavily toward government, or government policy enthusiasts. There were three people representing industry, but with one exception, they seemed more involved with public policy issues than gut industry issues. As a consequence, this group lacked the focus and crispness (and the short-term industry focus) of the Blue Team I represented in Palm Springs. As with that group, however, their highest priority assumption was that it is vital that the US be a global leader in electronics and information products. Their highest priority option was that government should concentrate its resources on infrastructure, but there was insufficient time to explore what that really meant.

The Purple team came up with essentially the same strategy as did that same team in Palm Springs. That leads me to believe that we are far more effective in understanding our weaknesses than we are in exploiting our strengths.

First Memorandum to the President for Blue Team II

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on mass market, high value-added, information-related electronics.

Assumptions:

- There will be continual regional conflicts (wars)
- Segregation of technology have/have nots.
- National defense cannot be left to dynamics of free market place.
- The bifurcated/bimodal world will continue to get worse.

Options:

- Downsize government lab base & apply savings to industry incentives for R&D product development.
- Maintain core competency base in government labs.
- Incentives for more research (tax credits, etc.)
- Identify, remove or modify government regulations which impede private investment.
- Accelerate relaxation of restrictions on exports.
- Major increase in catalyzing investments in education reform/improvement.
- National direction for science & technology emphasis on education.
- Industry increase involvement in education.
- Better international regulations & enforcement of intellectual property rights.

Recommendations:

I. It should be the policy of this administration to reduce non-value added regulations in export restrictions, environmental issues....

and to shift investments from direct government performed R&D to university and industrial R&D activities while maintaining core competence for defense-related requirements.

II. Furthermore we need to focus and catalyze education reforms.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years:

Cost Neutral

First Memorandum to the President for Blue Team II (Modified)
(Minor changes - will flesh out later)

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on mass market, high value-added, information-related electronics.

Assumptions:

- There will be continual regional conflicts (wars)
- "University" broadened to K-12, University and Vocational Education
- National defense cannot be left to dynamics of free market place.
- There will continue to be a segregation of technology have/have nots.
- The bifurcated/bimodal world will continue to get worse.

Options:

- Downsize government lab base & apply savings to industry incentives for R&D product development.
- Maintain core competency base in government labs.
- Incentives for more research (tax credits, etc.)
- Identify, remove or modify government regulations which impede private investment.
- Accelerate relaxation of restrictions on exports.
- Major increase in catalyzing investments in education reform and improvement.
- Develop a national direction for science & technology emphasis on education.
- Increase industry involvement in education.
- Better international regulations & enforcement of intellectual property rights.

Recommendations:

I. It should be the policy of this administration to reduce non-value added regulations in export restrictions, environmental issues....

and to shift investments from direct government performed R&D to university and industrial R&D activities while maintaining core competencies for defense-related needs in the government laboratories.

II. Furthermore we need to focus and catalyze education reforms.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years:

Cost Neutral Public Investment

Second Memorandum to the President for Blue Team II

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of the US industrial base, with a focus on mass market, high value-added, information-related electronics.

Assumptions:

- There will be continual regional conflicts (wars)
- "University" broadened to K-12, University and Vocational Education
- National defense cannot be left to dynamics of free market place.
- There will continue to be a segregation of technology have/have nots.
- The bifurcated/bimodal world will continue to get worse.

Options:

- Downsize government lab base & apply savings to industry incentives for R&D product development.
- Maintain core competency base in government labs.
- Incentives for more research (tax credits, etc.)
- Identify, remove or modify government regulations which impede private investment.
- Accelerate relaxation of restrictions on exports.
- Major increase in catalyzing investments in education reform and improvement.
- Develop a national direction for science & technology emphasis on education.
- Increase industry involvement in education.
- Better international regulations & enforcement of intellectual property rights.

Recommendations:

I. It should be the policy of this administration to re-engineer government regulations, so that they add value to national competitiveness, e.g.:

   a. Reduce export controls on widely available goods.
   b. Stimulate industry consortial activities through manufacturing stages.
   c. Streamline procurement practices and requirements.
   d. Emphasize outcome-based vs. prescriptive environmental regulations.

II. Shift investments from direct government performed R&D to university and industrial R&D activities while maintaining core competencies for defense-related needs in the government laboratories. Apply the savings to, e.g.:

a. Highly-leveraged tax incentives.
b. Catalytic, generic technology development (such as SEMATECH).
c. Replace research investments previously supported by defense-related activity with long-term basic university research.
d. Create a National Senior Scientists Corps to support educational initiatives.
e. Consolidate toseveral federal "corporate" laboratories to serve defense needs.

III. Focus and catalyze education reforms across the spectrum from pre-K through secondary, vocational training, and universities.

a. Convert federal involvement from prescriptive to empowering.
b. Incentivize business involvement and support of education, e.g. curriculum development, access to corporate training facilities, ...etc.
c. Encourage educational experimentation, e.g. market-based school selections, etc.
d. Increase nationalemphasis on science and technology education.
e. Stimulate use of NII and other advanced technologies in education.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years:

Cost Neutral Public Investment

Blue Team II -- Analyst's Report

Assumptions:

The Blue Team made a number of assumptions regarding the future state of events which form the basis for the team's recommendations. Most of these assumptions are with respect to national security issues. The team expects that there will continue to be regional conflicts throughout the world. As is the case today, these conflicts will include low-intensity armed battles at any given time. In addition to the regional conflict issue, national security will be impacted by the continued segregation of technological haves and have-nots. As a consequence, the world will become even more bi-modal in terms of income distribution and wealth.

Together, these issues imply that the nation cannot allow national defense to be left to the dynamics of the free market. It will remain the responsibility of the national government to maintain an active role in defining and meeting the needs of our mutual defense.

The other issue which formed the basis for discussion during the assumptions phase of the session was education. It was felt that education can play a critical role in ensuring the nation's capabilities in the technological arena. The team felt that it was overly constraining to consider education to be solely the role of the universities. The team has chosen to interpret education to include the entire system from K through 12.

Options:

The team identified a series of options to consider as the basis for their recommendations to the President. The options fall into roughly four groups. The first group relates to the future of the national laboratory system. The option considered was to downsize the laboratory base and use the savings as R&D incentives to industry. Nonetheless, it was felt necessary to maintain a core competency base in the government laboratories.

The second area of concern was direct government actions with respect to the marketplace. Options considered included incentives for research (for example, tax credits), identification of government regulations which impede private investment, and actions to identify, relax or remove restrictions on exports.

Options considered in the educational area included major new investments in education reform and improvement with the goal of catalyzing actions by the larger community. Recognition of the local control of school content and the consequent variation in caliber of graduates led to consideration of a national direction for science and technology. Finally, the team investigated ideas regarding the increase of industry involvement in education.

The final topic considered by the Blue Team was the possibility of government actions to strengthen competitive position through international regulations and enforcement of intellectual property rights.

Recommendations:

As can be seen in the presidential memo, the Blue Team chose three areas on which to focus attention. The first is in the regulatory area. The recommendations cover export controls, formation of consortia by industry, streamlining procurement practices, and the nature of environmental regulation. Together these policies are intended to act in a manner that does not dilute current regulation, but in fact allows the regulations to add to national competitiveness.

The second area of recommendations regarded a shift in investment of government funds from government performed R&D to university and industrial R&D activities. In sizing this shift, it is recognized that there is an essential need to maintain core competencies for defense related needs in government laboratories. Examples of activities to achieve this goal include highly leveraged tax incentives, support for generic technology development, replacing defense-lab research activities with university research funding on a long-term basis, creation of a National Senior Scientists Corps to support educational initiatives, and finally, consolidation of several of the national laboratories into a smaller grouping.

Educational concerns formed the basis for the third area of recommendations. These recommendations recognized the political difficulties of supplanting local control with control at a national level. Instead, policies intended to motivate from a national level were considered. Among the recommendations were providing incentives to businesses to become more involved and supportive of education - for example, curriculum development, access to corporate training facilities, etc. In addition, recommendations were made to encourage educational experimentation, such as market-based school selection. A strong need was recognized to increase the national emphasis on science and technology education. The team felt that the NII could be used as part of this process.

Strategy Document 1 - Purple Team
Action Memorandum from the Purple Team

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of our Purple industrial base, with a focus on digital consumer electronics.

(The Purple Team is a free-trade block consisting of Japan, China, the 4 tigers, and India.)

Assumptions:

1. Purple team driven by long-term market share and profits as a means to world power.
2. US openness policies of today will be continued (universities, industrassociations....).
3. US continues to have social vs. economic conflict.
4. China will continue to grow and become major manufacturing entity.
5. US continues to be world's policeman.

Prioritize Strategies:

1. Continue to exploit US openness of university and industry groups, labs (strengthen our weakness in innovation and avoid R&D costs).
   --Fund US university/laboratory research
   --More of "our" students to US
   --CRADA's/joint ventures with US companies
   --Encourage US to fund universities
   --Heavy participation from "our block" in US trade groups to influence US policy
   --Propose international initiatives in S/W
2. Control high tech tooling by selling at low prices to gain market share.
   --Subsidize our domestic tooling industries
   --Subsidize sales to US
3. Promote government regulations in US ethics and accountability.
   --Encourage US environmental regulations
   --Support US role as world's policeman
   --Fund law schools to create more attorneys
   --Fund minority and social organizations
4. Targeted acquisitions of US companies in information rich, high-value added electronics.
5. Continue Japanese style of negotiating with US
   --Slow negotiation, token concessions, crisis agreement and no real trade openings.
6. Balkanize the states of US (gain political power there, cause internal conflict).
7. Influence US media.

Estimated Public and Private Investment per year to accomplish recommendations for next 20 years:

Purple Team Session I -- Analyst's Report

Team Characteristics:

Despite the presence of actual government and laboratory players, the Purple Team behaved in a manner very similar to the industry-dominated EIA Purple Team. The many similarities between the two teams was so striking that it could be presented as a "universal American view" of foreign competitors. In both prototyping sessions, the industry, government and laboratory representatives were portrayed as wholly supportive of industry's position. Strategies involving subsidizing US universities, trade practices of questionable ethics, and promoting disinformation were not opposed by any of the groups.

Assumptions:

- The team felt that Japan, China and Asia were the main competitors. Europe was considered "irrelevant." This differs from the EIA decision to represent Japan, France and the Netherlands as the main US competition. However, both teams actually behaved very similarly during the game; i.e., no consortium was ever represented. Rather, the players behaved as though they were representing a single, generic country (which they called a "composite"), which almost always was Japan. This behavior was so strong and consistent between the two prototypes that it should be accepted as a game rule. That is, the concept of representing a generic, single foreign country should be adopted as an initial assumption.

- As in the EIA prototype (EIAP), the Purple Team assumed that they were "driven by market share and profits, not ethics"; a major goal was to make their industry competitive.

- Desire for political, economic and territorial dominance, further defined later to mean assuming their (the composite country's) "correct position in the world."

- US openness will continue - open door policy in universities, government, industry associations, etc.

- US will continue its conflict between economic and social issues.

- US will continue as world's policeman.

- No war in Middle East that cuts off oil.

- China will continue to grow and will become a major (possibly the dominant) electronics manufacturing country.

Strategies (Recommendations):

- Exploit US openness to gain technology inroads; compensate for our weakness in innovation; create venture funds in Silicon Valley. Our huge trade surplus allows us to capitalize on ~~U~~US cheaper than doing research and avoids long-term costs of R&D.
  - Fund US university and lab research, "think tanks," CRADAs, alliances, and joint ventures with US companies, universities, and labs.
  - Encourage US to fund universities to develop technologies that we can exploit.
  - Send graduate students to US.
  - Participate in (infiltrate) US trade groups to influence US policy and roadmap making.
  - Propose international initiatives in software.

- Control high-tech tooling by selling at low prices to gain market share.
  - Subsidize Purple tooling industries.
  - Subsidize sales to US; control "pinch points" like epoxies, subunits.

- Support US government regulations in ethics, accountability, environmental protection. Fund minority and social organizations to increase social disruption.

- Support US role as world's policeman; increase defense spending.

- Fund law schools to create more attorneys.

- Acquire US companies that develop the lead in information rich, high-value-added electronics. **Note:** *An important discussion took place which was not presented in the Purple Action Memorandum. The following arguments were made: "Attack the low end of capital intensive markets like automobiles. Encourage US to concentrate on high-value-added, high-technology (but low profit) items; concentrate on commodities. Continue dominance in commodity products. Let US focus on developing technology and high-value-added, info-rich electronics."*

- Continue Japanese style of negotiating with US; i.e., negotiate for a long time, promise much but deliver little or nothing, make token concessions, crisis agreements, but no real trade opening. Keep the "apparent" trade imbalance low by buying relatively invisible assets in the US (like land).

- "Balkanize" the states; i.e., gain political power there, pit one state against another on locating plants, help elect friendly legislators; gain political power through economics.

- Influence the US communications media. Use CBS to promote individualism.

- Encourage standard open interfaces for products.

- Discourage US-owned manufacturing within the US; Purple-owned manufacturing in US is OK. Objective is to increase/capture market share.

- Encourage incentives and low-cost capital within the Purple block.

Analyst's Comments:

Many assumptions and strategies were identical to those voiced at the EIAP. In fact, there were only minor differences in topics and emphasis. The predominant view remained that current US laws, regulations, culture, and business practices all contribute greatly to the success of Purple countries. The key strategy was to support and encourage the existing US environment, and to continue to promote the current Purple policies (as perceived by the Team) in trade, market strategies, politics, obfuscation, and disinformation.

As at the EIAP, the Purple university and laboratory players made **no** attempt to defend or promote their educational systems or research facilities, vis a vis those in the US. There was also **no** opposition by the Purple government players to the unethical nature of the proposed trade, political or social tactics.

The adjective "high-value-added" was questioned when applied to high-technology products. In fact, the highest value added occurs for capital intensive products which are almost always basic commodities like cigarettes, autos, gasoline, steel. Electronics and aircraft are about average in terms of value added per worker.

Modified Strategy Document 1 - Purple Team
Action Memorandum from the Purple Team

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of our Purple industrial base, with a focus on digital consumer electronics.

(The Purple Team is a free trade block consisting of Japan, China, the 4 tigers, and India.)

Assumptions:

1. Purple team driven by long-term market share and profits as a means to world power.
2. US openness policies of today will be continued (universities, industrial associations...)
3. US continues to have social vs. economic conflict.
4. China will continue to grow and become major manufacturing entity.
5. US continues to be world's policeman.

Prioritized Strategies:

1. Continue to exploit US openness of university and industry groups, labs (strengthen our weakness in innovation and avoid R&D costs).
    -- Fund US university/laboratory research
    -- More of "our" students to US
    -- CRADAs/joint ventures with US companies
    -- Encourage US to fund universities
    -- Heavy participation from "our block" in US trade groups to influence US policy
    -- Propose international initiatives in S/W
    -- Globalize the NII (e.g., encourage international standards body through US subsidiaries)
2. Control high tech tooling by selling at low prices to gain market share.
    -- Subsidize our domestic tooling industries.
    -- Subsidize sales to US.
    -- Label any US attempt to similarly subsidize as unfair trade practice.
    -- Respond to US attempts to negate this activity by emphasizing division in industry groups.
3. Promote government regulations in US ethics and accountability.
    -- Encourage US environmental regulations
    -- Support US role as world's policeman
    -- Fund law schools to create more attorneys
    -- Fund minority and social organizations
4. Targeted acquisitions of US companies in information rich, high-value added electronics.

5. Continue Japanese style of negotiating with US
   -- Slow negotiation, token concessions, crisis agreement
      and no real trade openings.
   -- Develop series of strategies for obfuscating trade imbalances (e.g. use third nations)
6. Balkanize the states of US (gain political power there, cause internal conflict).
7. Influence US media.
8. Erect barriers to direct foreign investment.
9. Existence of trade block is disinformation.

Recommendation(s) (Group into three or less for assessment):

I.

II. [No entries]

III.

Estimated Public and Private Investment per year to accomplish recommendations for nest 20 years:

[No entry]

Strategy Document 2 - Purple Team
Action Memorandum from the Purple Team

As requested, we are providing the assumptions, options, recommendations, and projected outcomes from our deliberations on how to increase the competitiveness of our Purple industrial base, with a focus on digital consumer electronics.

(The Purple Team is a free trade block consisting of Japan, China, the 4 tigers, and India.)

Assumptions:

1. Purple team driven by long-term market share and profits as a means to world power.
2. US openness policies of today will be continued (universities, industrial associations...)
3. US continues to have social vs. economic conflict.
4. China will continue to grow and become major manufacturing entity.
5. US continues to be world's policeman.

The Purple Team has decided to make no substantive changes to its strategies.
Maintaining current growth rates are sufficient to achieve our regions' objectives.
It is our intent to avoid trade wars by making minimal concessions as required.
We believe that the US has a great deal to lose if it were to initiate a trade war.
We are heartened by the Blue Teams' modest strategies.
We expect our long-term growth market to be dominated by the Pacific Rim.

Strategies (Recommendations):

1. <u>Economic Strategy</u>

A. Continue to exploit US openness of university and industry groups, labs (strengthen our weakness in innovation and avoid R&D costs).
   -- Fund US university/laboratory research
   -- More of "our" students to US
   -- CRADAs/joint ventures with US companies
   -- Encourage US to fund universities
   -- Heavy participation from "our block" in US trade groups to influence US policy
   -- Propose international initiatives in S/W
   -- Globalize the NII (e.g., encourage international standards body through US subsidiaries)

B. Control high tech tooling by selling at low prices to gain market share.
    -- Subsidize our domestic tooling industries.
    -- Subsidize sales to US.
    -- Label any US attempt to similarly subsidize as unfair trade practice.
    -- Respond to US attempts to negate this activity by emphasizing division in industry groups.
C. Balkanize the states of US (gain political power through economic influence).
D. Targeted acquisitions of US companies.

2. <u>Political Strategy</u>

A. Promote government regulations in US ethics and accountability.
    -- Encourage US environmental regulations
    -- Support US role as world's policeman
    -- Fund law schools to create more attorneys
    -- Fund minority and social organizations
B. Erect barriers to direct foreign investment.
    -- Exploit inevitable human rights violations in China to slow most favored nation's status.
C. Influence US media.
D. Continue Japanese style of negotiating with US
    -- Slow negotiation, token concessions, crisis agreement and no real trade openings.
    -- Develop series of strategies for obfuscating trade imbalances (e.g. use third nations)
E. Existence of trade block is disinformation.

Purple Team Session 2 -- Analyst's Report

After receiving the Presidential Review Briefing, the Purple Team reconvened. The response was very similar to the EIAP response to hearing the Blue strategies:

- "We are not afraid of the Blue Teams; there is nothing there that frightens us. The situation is almost laughable."

- However, deeply assuming their Purple roles, the team believed that they "needed to be more subtle." They did not want to give the impression that they were "going too far," or that they wanted "to damage the US." Some strategies were revisited:
  - We should avoid large trade imbalances. Let the US export stuff that helps reduce the imbalance.
  - However, continue to inhibit US from making investments in Purple countries by erecting barriers to direct foreign investment.
  - Try to "obfuscate the real trade imbalance by hiding imports through third countries"; develop "facade companies in the US."
  - If the US tries to subsidizes some American industries, label those attempts as "unfair subsidies" or unfair trade practices. Try to negate this strategy by emphasizing the division in industry groups.

- Despite the desire to be more subtle, aggressive strategies were still suggested:
  - Foment civil rights problems in China; the goal would be to have China lose its most-favored-nation status. It was recognized that this was to the benefit of Japan, rather than a joint Japan-China alliance. It was also recognized that this strategy may be risky.
  - Isolate the US more than it already is.

- The NII was considered an area of concern. Purple suggested globalizing the NII and encouraging international standards bodies through their US subsidiaries.

- At this point, the team recognized that it had never acted as a "trade bloc," despite having defined itself as one at the outset of the first session. They were actually behaving as a generic or "composite" country, most closely resembling Japan. They decided to "confess" that the "existence of a trade bloc was disinformation."

After hearing the Green Team assessments, the Purple Team reconvened at 2:00 for its final team session. The consensus was unchanged: "Both Blue Teams are wimpy." Purple would stick with their initial strategy. Minor changes in wording were considered, as well as making the style of the memorandum less aggressive.

- A trade war should be avoided. Minor concessions were considered that could mollify the US; this might include locating more manufacturing in the US, and making a show out of increasing procurements on an industry to industry basis. Nevertheless, the primary strategy

was still to skirt US trade concerns, e.g., by taking advantage of NAFTA. Although Purple would like to avoid a trade war, they were convinced that the US would lose.

- The analyst asked if weakening the US too much might reduce the US market for Purple products. The team was unconcerned. The US would continue to be a service-based economy selling those things that it could - primarily fluff. Asia was seen as the long-term growth market; the US was seen as an interim but stagnant market. Ultimately, Purple would become first world, and the US second world. This lack of concern about the US market was similarly expressed in the EIAP Purple session. A counter example was presented of 16th century Spain. Spain became a country that converted heavily into a service-based economy dependent on American gold and silver; in 50 years they went from a world power to nothing when the money dried up.

- The facilitator suggested that the team put themselves back in their respective group roles. For example, would the Purple universities object to funding US universities and sending Purple students to American institutions? The university representative said that Japan would like to have American students. However, there was quick agreement that the universities have no say in government policy; the Purple strategies are dominated by industry. This same conclusion was drawn at the EIAP.

- The Purple Team was puzzled by the Green Team assessment. Did Green evaluate the effect of Purple strategies on the US economy, or on the Purple economy? What did the scores mean? Business-as-usual means that Purple wins maintaining present Purple growth rate is sufficient.

APPENDIX D
QUANTITATIVE 20-YEAR PROJECTIONS OF TEAM STRATEGIES

Figure 1. Blue Team I, Session 1 qualitative judgments on benefits translated into quantitative projections by Green Team algorithm (projections: baseline - solid lines; upper - dashed lines; mean - dot-dashed lines; lower - dotted lines).

Figure 2. Blue Team I, Session 1 judgments translated into quantitative projections of jobs, tax revenue, and return on investment.

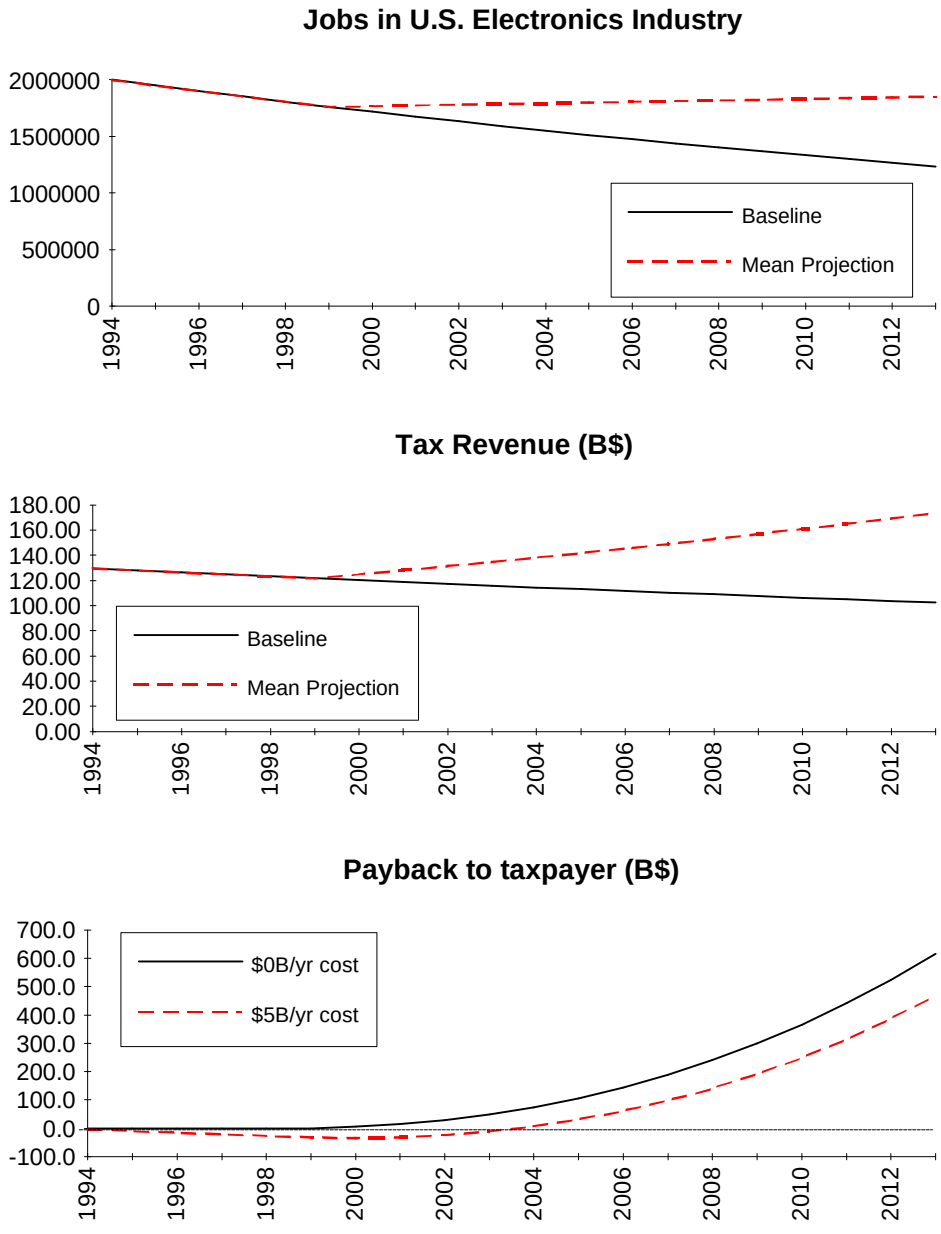


Figure 3. Blue Team I, Session 2 qualitative judgments on benefits translated into quantitative projections by Green Team algorithm (projections: baseline - solid lines; upper - dashed lines; mean - dot-dashed lines; lower - dotted lines).

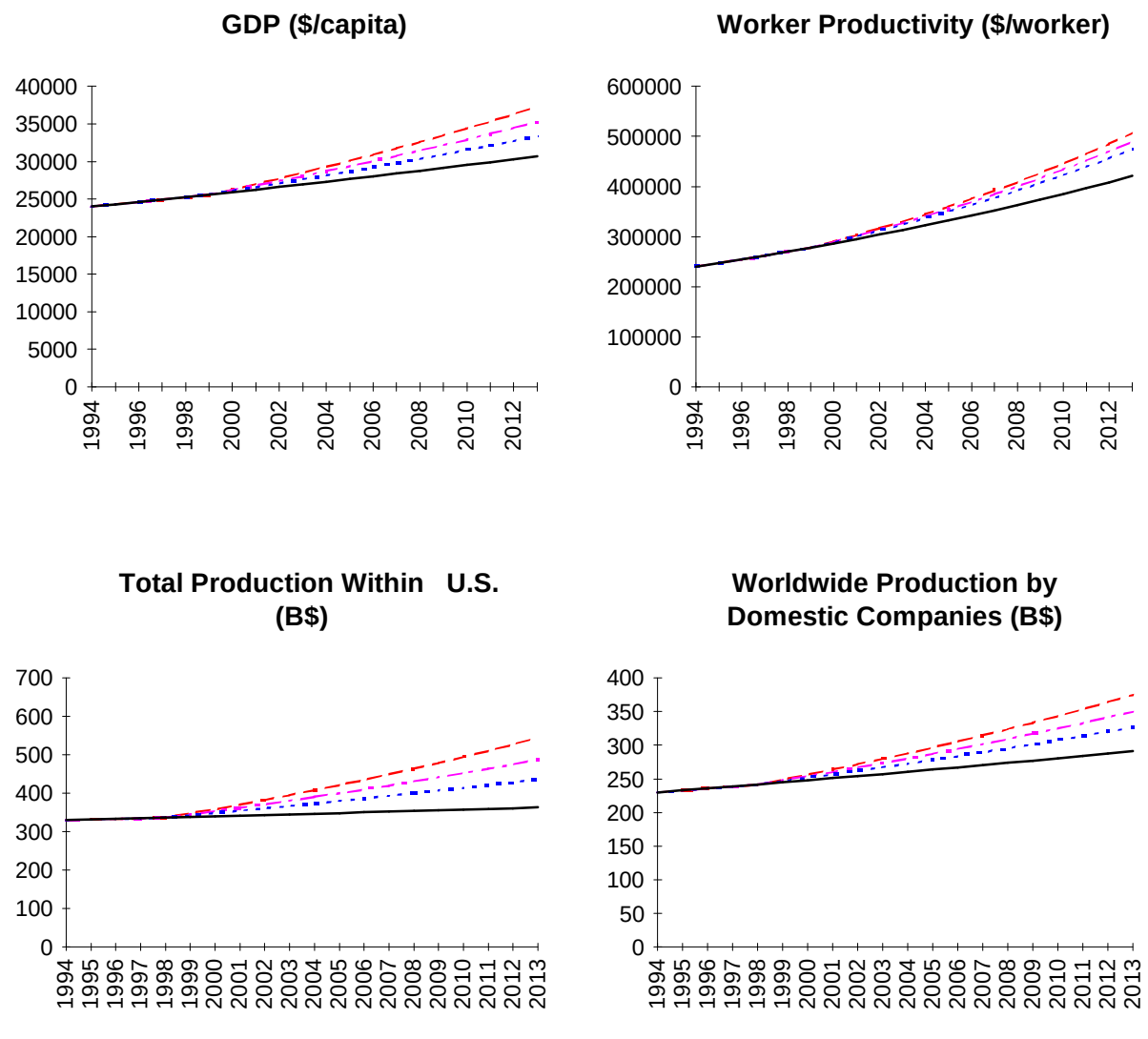


Figure 4. Blue Team I, Session 2 judgments translated into quantitative projections of jobs, tax revenue, and return on investment.

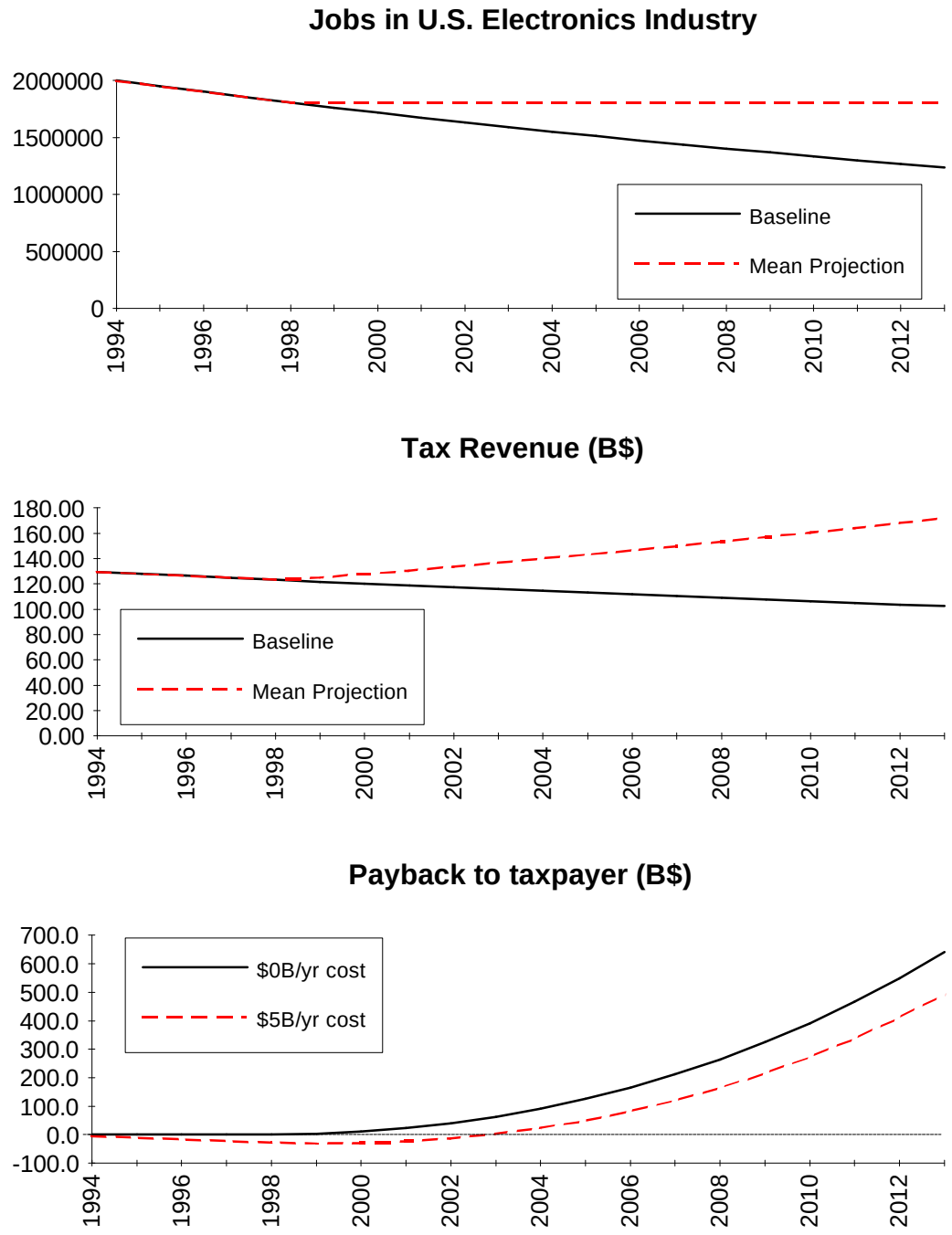


Figure 5. Blue Team II, Session 1 qualitative judgments on benefits translated into quantitative projections by Green Team algorithm (projections: baseline - solid lines; upper - dashed lines; mean - dot-dashed lines; lower - dotted lines).

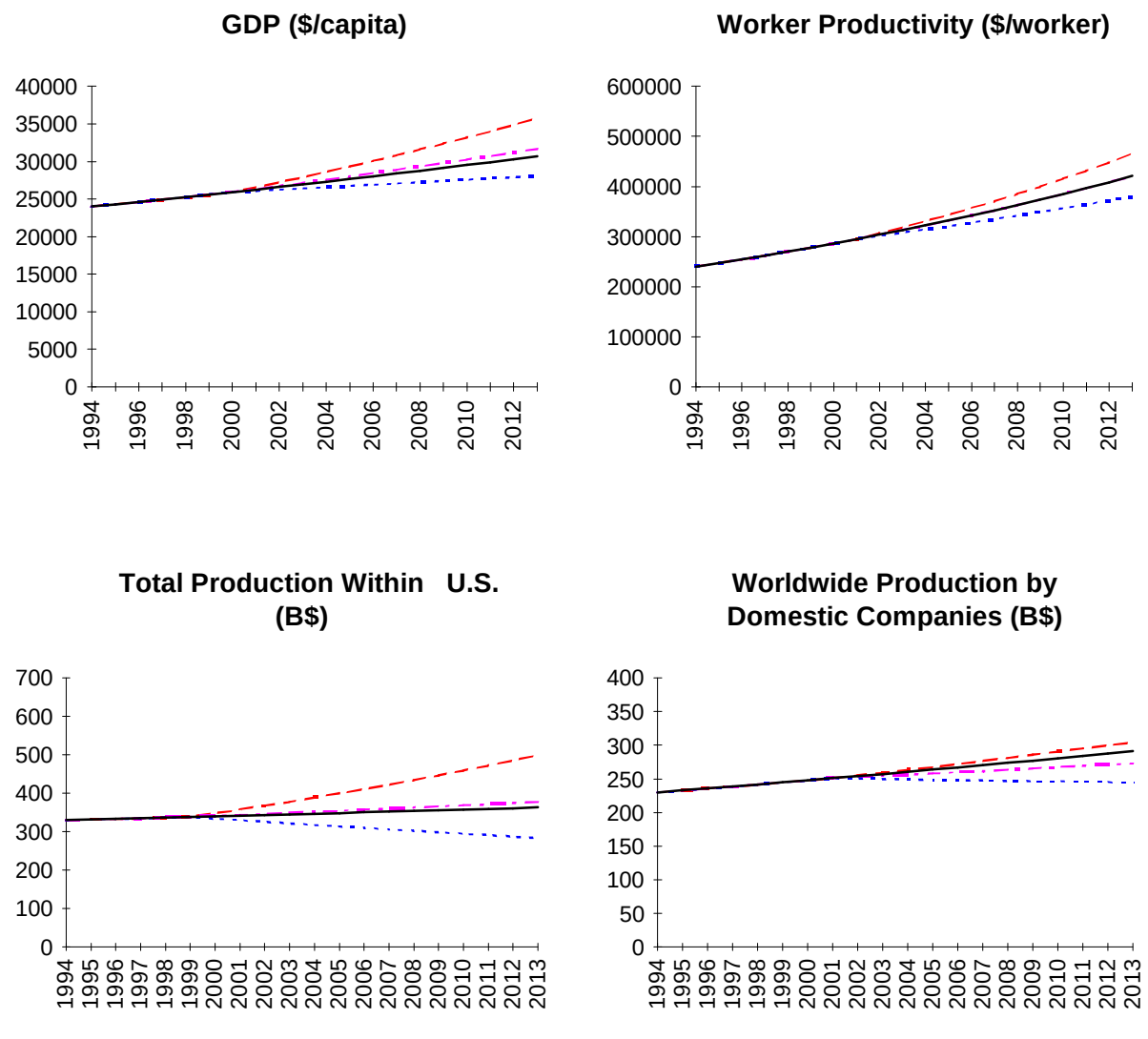


Figure 6. Blue Team II, Session 1 judgments translated into quantitative projections of jobs, tax revenue, and return on investment.

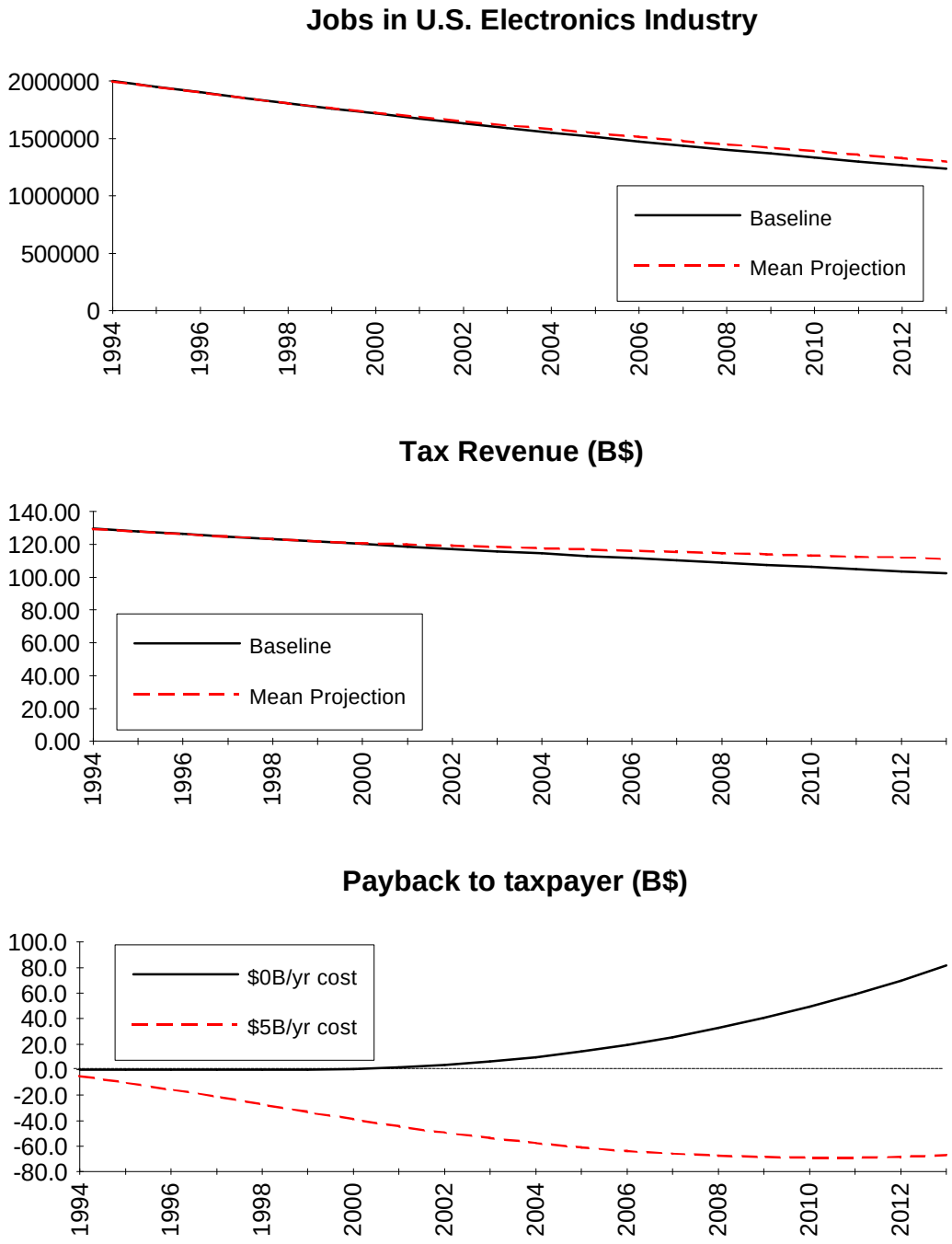


Figure 7. Blue Team II, Session 2 qualitative judgments on benefits translated into quantitative projections by Green Team algorithm (projections: baseline - solid lines; upper - dashed lines; mean - dot-dashed lines; lower - dotted lines).

Figure 8. Blue Team II, Session 2 judgments translated into quantitative projections of jobs, tax revenue, and return on investment.

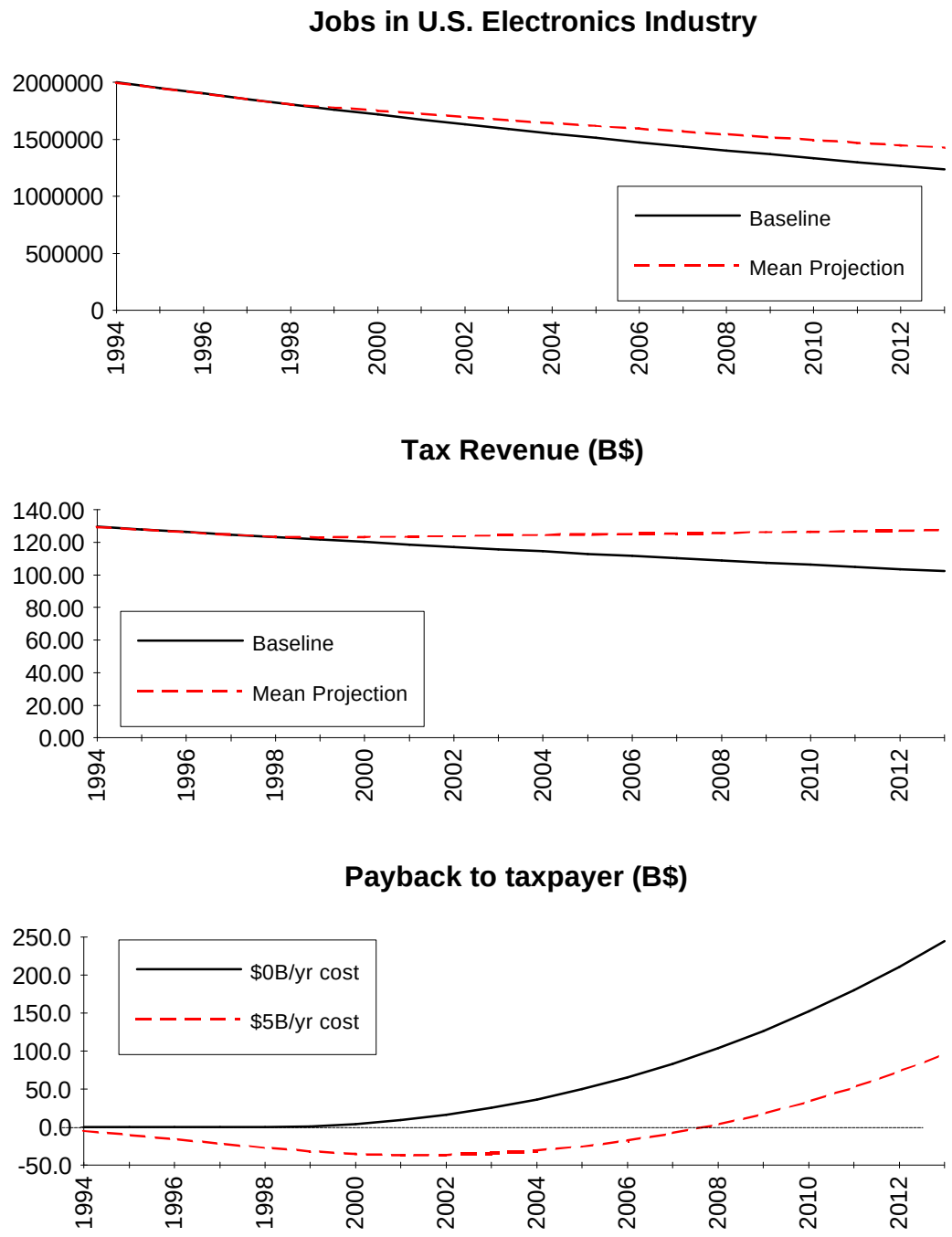


Figure 9. Purple Team, Session 1 qualitative judgments on benefits translated into quantitative projections by Green Team algorithm (projections: baseline - solid lines; upper - dashed lines; mean - dot-dashed lines; lower - dotted lines).

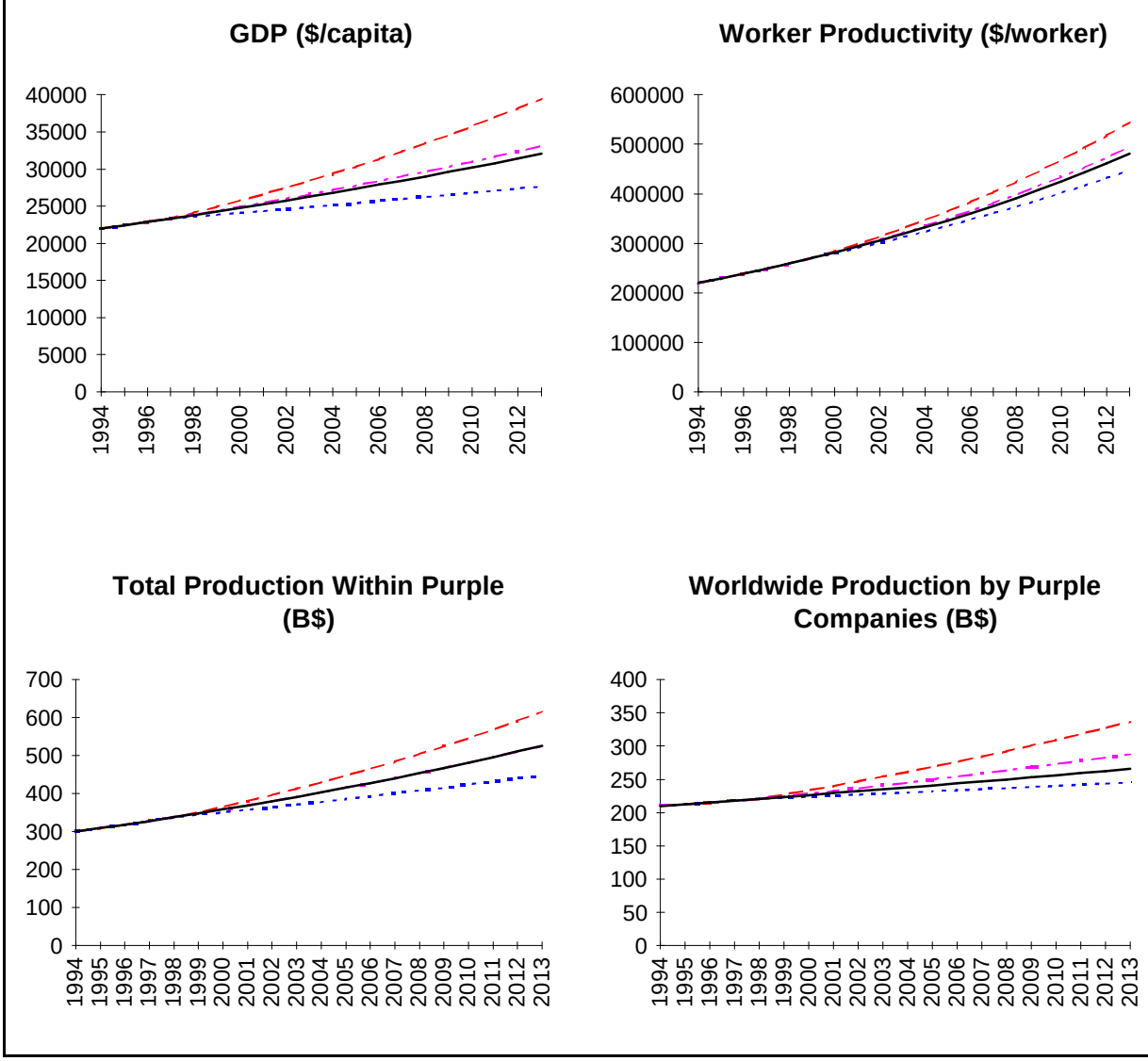
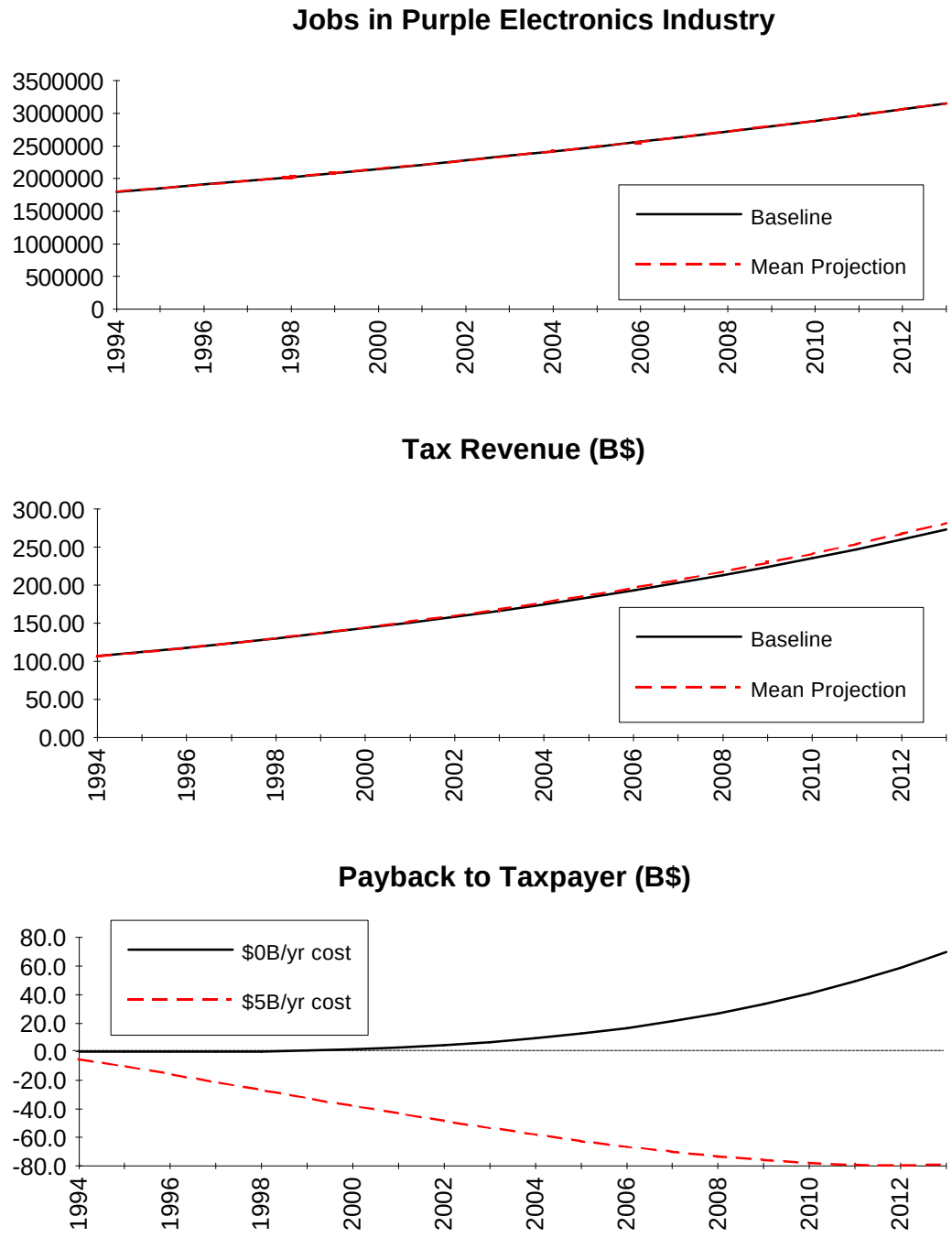


Figure 10. Purple Team, Session 1 judgments translated into quantitative projections of jobs, tax revenue, and return on investment.



APPENDIX E

NOTES ON GLOBALIZATION PRESENTATION
by Michael F. Oppenheimer

I. Definition of Globalization

A. Interdependence:

1. Our economy depends on the health and openness of the world economy.
2. Independent from government policy.
3. Blurs national character of firms.
4. Constrains what governments can and should do through formal policy.
5. Cuts into leverage governments have over their economies.

a. Complicates their constituencies;
b. Shifts the focus of policy from the old trade agenda to the fundamentals of U.S. income, quality of life, etc.

II. Why firms go global

A. Defend domestic base.
B. Seek out high growth markets.
C. Access knowledge/technology.
D. Improve servicing of existing foreign markets that would be lost through passive, export oriented strategies.
E. Maximize global efficiencies.

These strategies were made possible by post war U.S. trade policy (open markets, free floating exchange rates, national treatment for investors, privatization/market reform) but has now gone well beyond the point where "foreign economic policy" can be of much benefit.

III. Globalization Indicators

A. Growth and profitability of U.S. firms depend on a foreign presence -- as investors, manufacturers, innovators, not merely as importers.
B. Global firms grow twice as fast as others.
C. Foreign sales 35% of total sales for large U.S. companies, with exports from U.S. plants only 7.6%.
D. For smaller companies (100-500,000,000 sales) foreign sales are 22% of total.
E. Global firms are more profitable than firms that access foreign markets through exports.
F. Big increase in foreign investment in the U.S.
G. Slower increase in U.S. investment abroad.
H. U.S. imports and exports as percent of GDP from 4.5% in 1960 to 10.7% in 1990.

IV. In this Global economy, recent U.S. competitive performance is outstanding.

A. Growth rate
B. Inflation
C. Job creation
D. Productivity growth
E. Global market shares
F. Recent gains in key industries -- computers, microelectronics, semi-conductors, telecommunications, financial services, software -- even consumer electronics (HDTV)
G. Manufacturing efficiencies, by industries (cars, steel, etc.)
H. Corporate profits

V. Some reasons to be optimistic that this will continue

A. U.S. firms lead in re-engineering for global competitiveness
B. Open economy
C. Flexible adjustment, minimal regulation
D. Deficit reduction
E. Healthy investment numbers and productivity growth
F. Some useful innovations in U.S. government trade policies:

1. Getting tough with Japan
2. NAFTA
3. Big emerging markets
4. Aggressive export promotion (export control liberalization; President as salesman)

G. Competitiveness of U.S. based manufacturing

VI. What is left for government?

A. Focus on the basics -- global growth, increasing investment, education and training, infrastructure, support for enabling technologies.
B. Bust open big emerging markets where access is a problem.